Cropland Management Plan

Ottawa National Wildlife Refuge
14000 St. Rte 2
Oak Harbor, Ohio 43449

U.S. Fish and Wildlife Service
Department of the Interior

Submitted by: Ross Adams Date 12-14-94

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INTRODUCTION

The 5203 acre Ottawa Unit of the Ottawa National Wildlife Refuge was established in 1961 under the Migratory Bird Conservation Act "for use as an inviolate sanctuary, or for any other management purpose for migratory birds". This is accomplished primarily through the preservation and improvement of a portion of the remaining Lake Erie marshes for the benefit of waterfowl and other wildlife. Currently, the refuge acreage is classified as follows: 2802 acres of various wetland types, 205 acres of forestlands, 900 acres of grasslands, and 600 acres of croplands. Of the 600 acres of croplands, approximately 200 acres remain idled as domestic grasses used to support the refuge goose hunting program. The idled fields may be rotated into the cropland schedule to set back succession, restore the grasslands, and/or provide additional food resources for the Southern James Bay goose flock if needed.

This plan addresses the management practices on approximately 600 cropland acres and 900 moist soil plant acres of the refuge which will be managed to assist the refuge in meeting its objectives by providing food sources for migrating waterfowl. A portion of the cropland acreage will be planted to a cover crop, such as grasses or clover, which will provide green browse, nesting cover, and provide soil nutrients and other benefits to the soil. These cover crop areas will be periodically rotated into a row crop program to provide for crop rotation and diversity. In addition, approximately 900 acres of the refuge is currently in a moist soil management program which requires rotational soil-tillage or cropping every 3 to 5 years to keep the units in an early stage of succession for maximum productivity. The moist soil units may be included in annual cropland programs to accomplish this rotation with the use of cooperative farming agreements and/or force account work.

This plan is written as a guideline for future management and is intended to permit some flexibility in the management of the cropland and moist soil management due to the variety of practices and land management techniques required. These might include rotation of moist soil units to flooded conditions for several years, periodic rotation to grasslands, provide for increased row-crops to offset increased soil tillage of the moist soil units in certain years, possible harvesting of the cover crops as hay to improve fall goose feeding areas, and use of cover crops as green browse strips near hunting blinds.

OBJECTIVES OF THE REFUGE:

Objectives of the refuge that are supported by this plan are as follows:

1) To provide feeding habitat for the bald eagle and other birds.

2) To provide maintenance habitat for migratory waterfowl during the spring and fall migrations.

3) To provide habitat for the maintenance of native resident fauna.

4) To provide the public with wildlife-oriented recreation opportunities when this objective is compatible with the first two.

RESOURCES OF REFUGE:

Climate:

The climate of the area is continental in nature, with moderate extremes of heat, cold, wetness, and dryness. The average annual rainfall approximately 32 inches, and is distributed throughout the year, with spring being the wettest season. Approximately 30 inches of snow is received each year.

The average annual temperature is 49 degrees. The area has an average frost free growing season of 184 days, running from April 24th to October 25th.

Soils:

The majority of the soils at Ottawa NWR are wet most of the year. They have a high clay content, with a great degree of water storage and plant-nutrient storage and release capabilities.

Toledo Silty Clay, Toledo Silty Clay Ponded, and Nappanee clay loam comprise the greatest percentage of the soil types. All soils are found in the moist soil units, but only the Toledo silty clay and Nappanee clay loam are found in the current cropland units. Both soils have the characteristics of poor drainage and poor permeability. The root zone is deep. Due to the high clay content(40-60%), the soils are difficult to work, become cloddy and crusty when dried, and are prone to a high degree of shrinking and swelling. Seeding and emergence is difficult. These soils are classed as class IIIw, which indicates limitations which reduce the selection of field crops and require special conservation practices. These soils are found primarily in farm units 1, a portion of unit 2, and units 6 through 16.

A portion of farm unit 2 is composed of Latty Silty Clay, which is similar in field capability class and soil characteristics to the Toledo soils.

For the refuge soils to be more productive, it will be important to till the soil and plant crops that will increase the soil texture, porosity, and the seed emergent capability. All of the cropland units are tiled with a pattern tile system. This entails a 3" or 4" tile drain every 40-70 feet with the tiles usually exiting

into an adjacent drainage ditch, either directly or through a larger (6" or 8") main tile. Some of the ditches and tile systems are in poor condition and heavy silted in due to lack of ditch cleaning and other maintenance over the past 10-15 years.

Soils on the refuge can be expected to produce 60 to 80 bushels of corn per acre, 22 to 32 bushels of soybeans per acre, 25 to 30 bushels of wheat per acre, and 2.5 to 3.0 ton of hay crops per acre, using normal farming and cropping methods. Up to 120 bushels of corn and 44 bushels of soybeans could be produced using intensive management techniques, such as high fertilizer rates, high yield hybrids, improvement of drainage systems, etc. However, these techniques are not normally utilized by current farming cooperator's and would require additional refuge investment in improving cropland fertility and drainage systems.

Facilities and Equipment:

The current facilities of the croplands include approximately eight(8) miles of drainage ditches, approximately 600 acres of tile systems, seven(7) pumps and pump structures, and three(3) miles of protective dikes. Most, if not all, of the cropland areas are tiled in some form. A complete listing of the physical facilities are given in Appendix B.

Farm type equipment available to support the cropland and moist soil program includes several tractors, a grain drill, a field disk, a heavy-duty offset disk, a 10' and a 14' spike tooth drags, 10 foot cultipacker, a 15' cultipacker/mulcher, a 4 bottom moldboard plow, and a heavy duty disk-plow,as well as several portable pumps.

In addition, heavy equipment consisting of an excavator, backhoe, bulldozer, small scraper, and dump trucks are available for support of the program.

HISTORICAL AND CURRENT PROGRAM

Prior to the establishment of the refuge over 2000 acres of the Ottawa NWR was in croplands. Many of the present dikes were constructed for the purpose of draining lands for the production of crops. From 1600 to 1800 acres continued to be cropped under refuge management from 1966 to the early-70's. Cropland areas during this period are shown in Appendix A. In 1972 and 1973, heavy storm damage to several dikes occurred and allowed extensive flooding of many croplands. Many dikes were not repaired for several years. As the dikes were repaired, the areas were converted into moist soil units rather than cropland. Thus, a gradual reduction of croplands has occurred since 1978 as croplands were converted to grasslands and moist soil management units. Appendix B shows the cropland acres by year and the corresponding waterfowl use. Currently there is approximately 600 acres in the cropland management program. Of this, approximately 120 acres is seeded to a plowdown mix of legumes and grasses and 200 acres is in perennial grass cover.

Duck and goose use are shown in a series of charts and graphs in Appendix B. This data shows duck use well above the refuge objectives prior to 1972 when the first major dike failures caused the loss of the majority of the croplands and several high quality marshes. Goose use also climbed steadily and peaked in 1972.

Waterfowl use declined significantly during the 1972- 1979 period and is attributed in part to reduced cropland acreage and deteriorated marsh conditions. Populations have increased since 1979 as the result of improved food conditions in the former cropland areas now managed as moist soil units. However, total waterfowl use is still considerably below the current refuge objectives and below the pre-1972 levels. The combined food resources of the present croplands and moist soil units have not yet totally replaced the food resources of the pre-1972 period. This cropland/moist soil management plan and other moist soil improvements are intended to restore some of those 1972 losses.

Crops on private lands in the general area are predominately soybeans and corn. Some wheat and hay crops are raised, but on a much smaller acreage Recent reports from the Soil Conservation Service indicate that there are approximately 111,000 acres of cropland in Ottawa County in 1984. Of this, approximately 59,000 acres were in soybeans and 14,000 in corn. An additional 20,000 acres were planted to small grains. In past years, when fall weather was suitable, over 80% of the private cropland may have been fall-plowed. However, in recent years, no-till farming techniques has become more acceptable and fall plowing in less prevalent.

However, the amount of grain left for wildlife on private lands is still considerably reduced from past years. Modern combines are now used for the harvesting of corn, rather than the old "corn-picker" which harvested ear corn and left considerable amounts of shell corn on the ground. Samples done on refuge harvested cornfields indicate that modern machines leave only 60-70 lbs/acre of waste grain which is cleaned up very quickly by refuge waterfowl. Waterfowl feeding flights of several miles are not energy efficient for refuge waterfowl to find food in these low quantities.

The refuge farming program has been primarily accomplished through the use of cooperative farming agreements. Under this program, the local farmers put in the crop and incurred all costs for seed and seedbed preparation. Before 1984, the farmer usually has received 2/3 of the crop and the refuge received the remaining 1/3, which was left standing in the field for wildlife use. Since soybeans provide the farmer with the highest income, most cooperators wanted to plant soybeans for their share. Corn and other non-row crops were planted for the refuge share. This practice makes it more difficult to accurately access the proper share values between the cooperator and the refuge.

Beginning in 1984, shares were determined by using a crop establishment cost vs estimated rental values to try to more equally determine the refuge shares. This allowed us to better offset crops grown entirely for the refuge use with soybeans which are harvested entirely by the cooperator. The crop sharing ratios was based primarily on the prevailing private farmland cash rental rates and the direct costs to the farmer to prepare an acre of crop to the point of harvest(Crop Establishment Costs).

Land Rental values were determined by periodic surveys of various land rental values within the nearby area and/or the annual index of "Cash Rents in Ohio" which is published by the Ohio Cooperative Extension Service. An index of farm custom rates is also published annually by the Ohio Cooperative Extension Service, (Appendix D). This index was used to establish the cooperator's variable costs for tillage and planting use in determine the costs to the cooperator. To encourage the planting of corn, a price differential was set between the rental values of corn and soybeans. Normally, this differential was $10-15.00 per acre less for corn. The costs to bring the refuge share of the crop to harvest are termed the crop establishment costs and should approximate the cash rental value of the land used by the cooperator's share of the program. Adjustments were often be made because of inconveniences to the cooperator such as caused by excessive planting of small fields or strips required to meet objectives of the hunting program, research programs, etc.

Crops of high value to wildlife and high value to the farmer, primarily corn, were shared by harvesting a set number of rows across the field. Some crops, such as small grains, cover crops, crops in moist soil units are of value to wildlife but produce little income to the cooperator or cannot be harvested by conventional methods, as in the case of moist soil units. The refuge retained the full portion of this crop as the refuge share of a cooperative agreement that includes other crops, such as soybeans, that are of high value to the farmer, but of little value to wildlife. The farmer then retained 100% of the soybean crop as his share of the agreement.

Problems in refuge crops such as late planting, low seed germination, etc. still occurred on a regular basis, often leaving the refuge crop with little production. Much of this was attributed to the fact that the cooperator had no financial interest in the crop. These various inconsistencies, problems, etc. often left the refuge receiving little under the cropland program.

In 1991, a new system was started in unit 9 and expanded to the entire program in 1992 and 1993. This system, modeled after the Desoto NWR system, split the soybean crop 2/3-1/3, with the refuge share being harvested and delivered to a local grain elevator. The refuge share of the soybeans was then returned to cooperators to compensate them for planting of corn, grain sorghum, and other crops used entirely by the refuge for waterfowl food resources. This has eliminated many of the old inconsistencies and gave us a much better cropland program.

However, in recent years, local farmers have lost interest in producing refuge crops. Low crop prices, combined with the depredations by refuge wildlife (deer and geese), absence of crop subsidies on refuge crops, and the poor drainage systems on refuge lands have not made refuge farming profitable for them.

Under the cooperative farming system, it was difficult to maintain good crop rotations since most cooperators were only interested in the soybean crops. It has been very difficult to require them to accept anything other than soybeans as their share of the crop. It has simply been uneconomical for them to plant corn on shares. Consider that corn costs approximately $150.00 per acre to grow and harvest, prices on corn are approximately $1.60/bu.(after drying costs), and that refuge lands can produce approximately 100 bu/acre in good years. Thus, if the cooperator gets 75% of the crop, is income is only $120.00/acre, (100*75%*1.60=120.00). Thus, the cooperator will likely loose approximately $30.00 per acre in a normal good year and even more in some bad years. If the cooperator was farming private land, this same situation would be profitable since the cooperator would receive another $1.20/bu from government subsidies or another $90.00/acre, leaving him a net profit of $60.00/acre.

In 1991, the cooperator farming units 9,10, and 11, went bankrupt and retired from farming. No suitable replacement cooperator was available and refuge personnel farmed the clover and corn fields in these units. Another existing cooperator planted the soybean areas under the 1/3-2/3 agreement. This arrangement continued in 1992. This cooperator lost approximately 50% of his crop in 1991 and almost all of the crops in 1992. He then declined to farm these areas any longer and refuge personnel took over the farming of these units in 1993 and produced good crops. The cooperator has now agreed to try some additional farming of corn and soybeans in unit 9 for 1994, but it appears that some refuge farming may still be needed.

However, greater force-account farming can have some advantages. Under a cooperative program, our cropland management costs are low, but actual food resources available to waterfowl are low and inconsistent. In many years, the cropland program produces little in the way of food resources, especially the refuge cornfields.

Under a force-account program, refuge managers have better control of the program and better crop management can be expected. In addition, 100% of the corn crop is available to waterfowl. Under any of the other systems, it was difficult to provide more than 60-80 acres of corn in any one year and at least 75% of this was harvested, leaving less than 20 acres for waterfowl. Under a complete force account program, it would be possible to provide at least 100 acres of corn on an annual basis and have all of it available to waterfowl.

A force-account program will also be a better land management program in that a good rotation or organic farming program can be implemented through the use of legume crops. A legume-legume-corn rotation would produce good corn yields with minimum fertilizer use at the same time provide better soil nutrient replacement and better soil management. However, this rotation is simply unacceptable to cooperative farmers. To attract cooperative farmers, 50-75% of the annual crop must be soybeans and a beans-beans-corn is the best rotation that we can get them to accept.

CURRENT PLANNED PROGRAM:

The current program is to include up to 600 acres in the cropland management program, with average annual acreage of about 400-500 acres. This will allow for a rotation of one year of corn, one year of soybeans, and two years of legume, usually sweet clover, red clover, and/or ladino clover. This will allow approximately 100-150 acres of corn, 100-150 acres of soybeans, 100-150 acres of first year clover and 100-150 acres of second year clover. Of this the clover will generally be planted by refuge force-account, and the soybeans by a cooperative farmer. Refuge personnel with prepare approximately 60-75 acres of corn for planting with the actually planting to be done by a contractor or cooperative farmer under contract or Cooperative Farming Agreement. The remainder will be planted by a cooperative farmer. This will provide waterfowl with approximately 80-90 acres of standing corn, 60-70 acres of harvested corn, and up to 300 acres of legume browse.

OBJECTIVES OF THE CROPLAND MANAGEMENT PROGRAM

In support of overall refuge objectives , the cropland management program will specifically assist in the accomplishment of each listed refuge objective as follows:

REFUGE OBJECTIVE

1. To Provide Feeding Habitat for the Bald Eagle and Other Birds.

Cropland Objective

To provide feeding habitat for bald eagles. Croplands can provide feeding habitat for bald eagles as eagles feed on migrating and wintering waterfowl.

REFUGE OBJECTIVE

2. To Provide Maintenance Habitat For Migratory Waterfowl During the Spring and Fall Migrations.

Cropland Objective

Crop Production in Moist Soil Units. The moist soil units may be tilled on a rotational basis every 3 to 5 years by planting crops such as wheat, millet, buckwheat, or sorghum using normal cropland techniques. A rotation that involves the planting of crops will provide waterfowl foods and keep woody growth from taking over moist soil units. Such associated tillage also restores moist soil seeds into the germination zones. When evaluations by the refuge staff determine that such tillage is beneficial, the moist soil unit rotations will be included in annual cropland plans. Both tillage and/or planting may be by the cooperative farmer, however, most cooperators are unwilling to do much tillage or planting in units that have significant brush growth and such tillage must be done with refuge personnel.

In many cases, local farmers can do a better job of planting because of better and more up-to-date grain drills, corn planters, etc. and because they are more familiar with their equipment. Cooperative farmers will be allowed to plant and maintain the crops and will receive a portion of the refuge soybeans as compensation.

Cropland Objective

To Provide Foods for Migrating Waterfowl. Refuge Croplands can provide direct waterfowl benefits by providing migrating waterfowl with high energy foods, especially corn and sorghum, as well as green browse for migrating geese. These croplands should provide up to 100 acres of corn or sorghum and 25-50 acres of green browse annually.

This can potentially produce up to 10,000 bushel or 500,000 lbs of corn each year to be available to migrating waterfowl during the winter and early spring months (Dec-March).

REFUGE OBJECTIVE

3. To Provide Habitat for the Native Resident Fauna.

Cropland Objective

To Provide for a Diversity of Upland Habitats. By utilizing crop rotations that involve cover crops, conversions to grass, and small grains, diversity will be increased above the soybean-corn rotations and will provide for a greater diversity of upland habitat.

REFUGE OBJECTIVE

4. To Provide the Public with Wildlife-oriented Recreation Opportunities When this Objective is Compatible with the First Three.

Cropland Objective

Provide Support to the Controlled Goose Hunt. Row crops and green browse strips planted adjacent to hunting blind locations will provide cover for blinds and a location for placement of goose decoys to enhance the quality of this hunt.

The objectives in this section were developed from objectives set for the refuge at the time of establishment, per the Refuge Manual and from guidance provided per the 1978 Refuge Master Plan.

The present master plan, which was written in 1978, calls for approximately 600 acres of cropland and 860 acres of moist soil units as waterfowl feeding areas and diversified habitats. This cropland plan establishes 600 acres of croplands in units 1, 2, 6, 9, 10, 11, and 12, as per the 1978 master plan. Former farm units 8, 13, 14, and portions of units 6, 9, 10, 11, and 12 are also included in the master plan, but have since been converted to grasslands or additional moist soil units. Some of these areas will be retained as currently managed and not included in this plan. However, some of the grassland areas are reverting to brush, primarily dogwood, and/or multiflora rose with little value to waterfowl and our current objectives. Some of these areas in units 13, 14, 15, & 16 may have value to neotropical migrants. After evaluation, some units may be reestablished as cropland at some point in the future to meet waterfowl objectives and provide some method of brush control. Approximately 150 acres of croplands in the presently farmed units, especially the remaining acreage of unit 12, are in cover crops of clover and other legumes. These areas are considered cropland as per definitions in the Refuge Manual(6 RM 4.3A). It is included to allow further crop rotation at a later date.

Cropland Needs:

Approximately 10 acres of corn and 30 acres of wheat or other green browse is desired as the refuge share of the crop to support the hunting program. This may be accomplished through crop-shares as specified in the cooperative agreements or by contracting the planting of crops.

In addition, unharvested corn acreage should be increased another 90-100 acres to provide additional food for wintering and spring waterfowl and approximately 30 acres of green browse for migrant geese. This green browse will also require approximately 25 acres of shared soybeans to provide the equal value and the additional corn will require up to 400 acres of row crops if farmed under cooperative agreements.

This is based upon the assumption that both ducks and geese will consume 1/3-1/2 pound of grain or seeds each day per bird. With a objective of 4.5 million duck use days and 1.5 million goose use days annually and at least 3/4 of this occurring during the fall and winter months when these foods are the primary source of energy for waterfowl, up to 2.25 million pounds of grain or moist soil seeds are needed. The 800 acres of moist soil plants can provide approximately 400,000 pounds annually for waterfowl use. Assuming that approximately 50-60% of this acreage will produce good moist soil plants in any one year and this production will be approximately 1200 lbs/acre and waterfowl can efficiently harvest only about 800 pounds/acre. Harvest below 400 lbs/acre becomes energy inefficient for waterfowl. Thus, the moist soil units can produce approximately 400,000 pounds of available seed and maintain up to 1,000,000 use days. (500 acres*800 lbs*2ud/lb= 800000 use-days). Even with 100% good seed production of the moist soil units, this figure can only be doubled to 1,000,000 pounds of seed and 2,000,000 days. This yield is quite unlikely in most years. Seed yields estimates in 1993 from the moist soil units showed a production of approximately 100,000 lbs for the 800 acres.

Some additional use-days can be supported by off-refuge grain fields, but this is minimal since most of these are inaccessible during much of the period due to intensive hunting pressure and the fact that modern combines leave little waste grain and some of this can be fall-plowed or tilled under. Thus, refuge waterfowl will still need approximately 1 to 1.5 million pounds of supplemental grain.

Thus, refuge grown standing corn is the remaining food source. Approximately 100 acres can produce up to 5000 lbs/acre or 500,000 pounds to support an additional 1,000,000 use-days. This still leaves a deficit of approximately 500,000 pounds of food during the fall and winter period. Normal marsh units, off-refuge feeding, above normal production of moist soil foods, etc can make up some of this deficient, but waterfowl foods will often be found limiting.

In order to provide the necessary cover crops and for the rotation for all croplands, approximately 1/4 to 1/2 of the total acreage will be kept in cover crops each year. If these crops are planted by cooperators, an additional acreage of shared soybeans will also be required to support the cover crops. Thus, up to 100 acres of legumes could be required each year and 100 acres of shared corn or soybeans would be needed to support this.

Thus, the above programs will require approximately up to 1000 acres of cropland to fully support the program via cooperative farming. However, this can be reduced to 600-650 acres by using refuge work force and equipment to provide some of the crops, primarily the green browse, cover crops, and some of the corn crop.

CROPLAND MANAGEMENT GUIDELINES:

While it is intended that some farming operations will be accomplished by the use of cooperator's, some operations may be best accomplished by the use of refuge equipment and personnel. This is especially true concerning the spring planting of the clover legume crops which is normally planted in April. At this time of the year, many cooperators are busy with tillage and planting on their own lands and do not give the refuge crops the priority they need for proper planting. Thus, refuge crops are prone to be planted later than desired. In contrast, refuge work may be slack at this time as moist soil unit are still not dry enough for tillage work or dike repairs, etc. Thus, seeding by refuge personnel often can insure a crop planted at the best time for proper growth.

In addition, cooperators may not be available for some of the refuge croplands. In this case, refuge personnel may have to take over the entire work program. The benefit of this is that the refuge will receive 100% of the crop. It will also require maintenance and replacement of farm tractors and equipment and additional staff-hours. However, much of this equipment is also needed in other moist soil management, dike maintenance, etc.

To accomplish some of the cropland management with refuge personnel does have some major benefits. Using refuge personnel, we can more easily go to a "organic" system with rotation of legumes with corn to reduce or eliminate much of the fertilizer requirements.

Mowing of standing corn and sorghum crops during the winter months will be primarily done with refuge personnel to allow for better timing of the mowing. Mowing will often be done in small blocks to provide available food over the entire period and as the waterfowl need the food.

To maintain soil productivity, increase wildlife diversity, and minimize soil losses, cropland fields will be rotated to different crops. Such crops will include row-crops such as corn and soybeans, and non-row crops such as buckwheat, wheat, and sorghum, as well as cover crops. The standard rotation will be a 4-year rotation of legume-legume-corn-soybeans.

To minimize topsoil losses and provide food and cover for wildlife, crop residues will be maintained on the surface during the winter months. Runoff or buildup of pesticides will be reduced by using a crop rotation system and utilizing crops that will require minimum pesticide use. Cover crops will be used in this rotation which will increase organic material, have low inorganic fertilizer requirements, and reduce the need for pesticides. Such crops will also provide good browse areas for migrating geese.

Complete fall tillage will not be allowed, but fall tillage with the newer "No-Till" implements such as the Para-Plow" or certain chisel plows may be allowed.

In general, cropland units will be placed in a rotation that includes one or two years of a legume, one year of corn, and one year of soybeans. It is anticipated that the legume crop can provide for most of the nitrogen requirements needed by the following corn crop which will reduce the needs for inorganic nitrogen and the costs associated with the corn production. Wheat or oats may be utilized before the cover crop or as the first year of the cover crop. Another alternative is to use two years of soybeans in order to provide additional support for the other crops and programs and to provide additional economic incentive to the cooperators.

Grass cover strips of 100-200 feet in width will be utilized on the edges of each field and in lower areas

to provide more diversity, reduce soil erosion, and keep large concentrations of feeding wildlife away from traveled roads. Some areas near hunting blinds may be managed as permanent green browse areas by sowing to winter wheat each year. Experience has shown that letting the wheat mature, then disk in August will produce good stands of volunteer wheat that will satisfy the green browse needs without additional planting.

To reduce the conflict between hunters and cooperators, the early harvest of crops, especially soybeans, will be encouraged and in some cases, required. This will require early planting and the use of early varieties of crops. The planting of early varieties of soybeans to allow harvest before the opening of waterfowl seasons may be feasible. This practice combined with the aerial seeding of a green browse crop such as wheat or rye into the soybeans prior to harvest can benefit the refuge hunting program by providing additional green browse near the hunting areas. It will also benefit other refuge programs and the cooperators by allowing soybeans to be grown on areas next to hunting blinds where a green browse strip would otherwise be required.

Problems may arise with reduced yields if early varieties of soybeans are not planted before May 15th-25th. Planting of a variety with a 121-125 day maturity on May 15th should give a potential harvest date of October 1st. However, weather may be an important factor in the drying of the crop. Wet field conditions may delay harvest and/or the beans may still have excessive moisture resulting in excessive drying costs, reduced market prices, etc.

For early planting, current recommended varieties are Vickery, Stine 2920, HP-20-20, AP-240, GSF-240, and HP- 2530. Any soybean with an early group II maturity could be used. Early planting is more important with early varieties to prevent yield loss as these varieties will otherwise blossom, set pods, and mature before adequate plant growth occurs.

Fall seeding of wheat or rye into soybeans will enhance these fields for hunting and for goose feeding areas. This technique was used in the 1960's and early 70's, but not in later years. It was used in 1990 with limited success. However, many area farmers use this technique to establish wheat crops. This practice will be encouraged whenever possible, especially where it can support the hunting program. Wheat would give a potential crop for harvest by the cooperator and provide income in the following year. However, rye may give faster emergence and better fall growth and may be better for use in hunting areas and where spring tillage and replanting is anticipated, or where there will be spring seeding to a plowdown mix.

The fall seeding of wheat or rye into corn with later spring seeding of a plowdown mix may be possible and would reduce the tillage necessary to establish a cover crop and maintain more soil cover. However, herbicide selection for the corn crop would be critical to avoid carry-over to the fall months. Wheat would provide a potential crop to the cooperator to offset the cost of planting the plowdown mix. However, in recent years, fall wheat has suffered extensive utilization by winter browsing geese and complete spring tillage and planting has become necessary.

SELECTION OF COOPERATORS:

The following priority shall be used in the selection of cooperators:

1. Previous permittee or cooperators
2. Former tenants or landowners
3. Resident neighbors
4. Non-resident neighbors

However, this will not preclude using the cooperator that the Refuge Manager feels is the best qualified in terms of equipment, experience, other commitment, etc. and will do the best job in accomplishing the refuge objectives.

In general, corn is not the primary crop for farmers in this area and most farmers prefer soybeans. Many area farmers are growing crops for the grain market and soybeans provides more income with less work and expense than does corn. Corn is more desired by farmers with beef or dairy herds and there are only a few dairy herds and almost no beef herds in this area. Thus, most cooperators or potential cooperators are not interested in growing corn for their own use. In selecting cooperators, it will be important to select a cooperator that is willing to make a substantial commitment to the corn crop and use it in his program. In general, someone in the dairy industry will be a good choice.

Crop Rotations

Conversion to crop-share farming and the above listed changes will result in changes to existing rotations. Consequently, the revised crop rotations are described in detail in table 6. This rotation is based primarily on a soybeans-legume-legume-corn rotation. Rotations over the past years were primarily a soybeans-corn rotation. However, this rotation has required large amounts of fertilizer applications to maintain soil fertility and crop yields. This has raised the cost of the crop, especially corn, to the point that it is uneconomical for both the cooperator and the refuge. Adding a legume crop to the rotation is intended to add natural nitrogen fertilizer and reduce the corn cropping costs to an acceptable level.

It is felt that the use of the soybeans-legume-corn rotation will provide a program that will support the cropland program and still provide for some tillage or crop practices on the moist soil unit, especially if the refuge personnel and equipment are used to establish the legume crop and provide some of the tillage on corn fields that the refuge will receive 100% of the crop. If additional economic incentive is needed to meet the needs of the program, a soybeans-soybean-legume-corn rotation may be used to increase the soybean acreage.

Table 6

Standard Crop Rotation

Season	Year One	Year Three	Year Four/Five
Spring	Clover-- Cooperator or refuge seeds clover with or without oats	Corn-- Cooperator prepares seedbed and plants corn, nitrogen and other fertilizers added as recommended by soil tests.	Soybeans Cooperator prepares seedbed and plants soybeans, fertilizer as recommended by soil tests
Summer	After July 15th, Cooperator or refuge clips (mows) oats and weeds to promote clover growth.	Standing Crop of Corn. Weed control by tillage or approved herbicide.	Standing crop of Soybeans. Weed control by tillage or approved herbicide. May be required to aerially seed wheat into standing soybeans in mid to late August
Fall	Nitrogen in legume added to soil through natural incorporation. Fall tillage may be allowed using high residue "No-Till" implements.	Cooperator harvests his share of crop (2/3 or 3/4). Refuge share left standing. Fall tillage not allowed.	Cooperator harvests soybeans. Refuge share (1/3) delivered to elevator. No fall tillage.
Winter	Residual Cover	After waterfowl hunting season, refuge mows remaining corn for waterfowl use.	Residual Cover

Note: Year Two is not shown as no management or operations are involved with the standing clover crop. It may be mowed by refuge personnel if weeds or heavy growth occurs. Fall subsoiling may also be desirable.

CONSERVATION PRACTICES:

The following soil and wildlife conservation practices will be used in all refuge croplands:

- A list of proposed pesticides used by cooperators must be submitted to the refuge manager and any pesticide used by cooperators must be approved before use. In general, only herbicides on the Regional Pre-approved chemicals will be used. and no insecticides will be used.

- Fertility and ph levels must be maintained on the croplands by application of fertilizers and other soil conditioners as recommended by the Soil Conservation Service or Agricultural Extension Service for the crop being planted. Soil samples will be made periodically and results of the analysis made available to the cooperator.

- Killing of wildlife doing damage to any crops will not be permitted. However, zon guns and other scare devices may be used to deter blackbirds and deer from crops.

- Crop residues will not be plowed or disked in the fall. Fall tillage, such as chisel-plowing or subsoiling, may be used on corn stubble or clover which may be tilled using methods that will leave most of the residues on the surface.

- Only single cropping will be permitted, except that wheat or other green browse may be planted on soybean fields through aerial seeding techniques for use as green browse. Such crops may be harvested the following year or may be tilled under and another crop planted in the following spring.

DETERMINATION OF THE REFUGE SHARE OF THE CROP:

The cooperator will harvest a share of the crop as his share or payment for putting in the crop and the refuge will receive a share of the crop as the owner of the land. While there still may be a method of fairly determining cash rent, a "true" crop-share system is a better choice for meeting refuge objectives. In addition, crop-share will remain equitable to both parties from year to year and prevent the inequities which have occurred in the past. Also, crop-share is a common method of leasing croplands in area and within the national wildlife refuge system. While force-account farming may be a better choice than crop-share for meeting refuge objectives, the economics of this option prevent it from being used entirely.

Several methods of crop-share are used in area cropland agreements, but only one is suitable for Ottawa refuge, that being a 2/3 or 3/4 share for the tenant (cooperator) and a 1/3 or 1/4 share for the landlord (refuge). This type of agreement is used when the tenant bears the cost of all farming activities, e.g., seed, fertilizer, tillage, machinery, fuel, herbicides, fertilizer, harvesting, and etc., required to raise a crop, while the landlord supplies the land and bears all costs associated with it. Other crop-share systems are also used, such as 60/40 or 50/50 ratios, but require the landlord to bear a portion of the cost for farming activities. Consequently, these would not be economically feasible as their use would require substantial contributions from a limited refuge budget.

Reference to the term "true" crop-share means that the refuge retains as their share 1/3 or 1/4 of all crops raised on a field-by-field basis, as opposed to the previous crop-share system where the refuge accepted the clover rotation, small grains, etc as its share. This may result in some reduction of the cooperator's share of the row crops over the present system, and will also result in an increase in available grain for wildlife. However, the cooperator will not have to bear the cost of the small grains, cover crops, etc. as these will be reimbursed when done by the cooperator.

The refuge share of corn can be left standing until spring to encourage more use by spring migrating waterfowl. Much of the needs of the waterfowl can be met with the moist soil units, however, the refuge may need additional grain to meet the waterfowl needs. The refuge's 1/3 share will potentially produce 150,000-200,000 pounds, but some portion of this available corn will be used by fall migrating waterfowl, non-game species, and resident wildlife. Potential fall use of standing corn is not high, but it is known that geese and ducks at Ottawa will readily use these crops during the winter and early spring months. In addition, these crops can be mowed or shredded at this time to increase the availability of the grain.

Soybeans will be 100% harvested with the refuge share being deposited in a local elevator and used as outlined below. The refuge share of the corn will normally be left standing in the fields as wildlife foods. However, some areas may be harvested completely to enhance hunting. In this case, the refuge share will be delivered to the elevator and handled similar to the soybeans. The refuge may also use this grain for bait in banding activities, etc.

Although the legume crop is grown primarily to provide the nitrogen nutrients for the following corn crop it also benefits the refuge in providing some green browse, ground cover, and diversity. Thus, this crop will be considered as part of the refuge share. In many cases, it may be advantageous for the refuge personnel to establish this crop directly rather than use cooperators. This will insure that the crop is planted immediately in the early spring to get maximum growth and nutrients. However, in some cases, it may be planted by the cooperator under the Cooperative Agreement and the cooperator may receive a higher percentage of the following corn crop. This may be desirable as it relieves the refuge work force of establishing the crop as well as gives the cooperator more benefits from the crop and thus, increases his commitment to properly manage the crop for maximum nitrogen benefits. However, past years have shown that waterfowl and wildlife values are much better when refuge personnel do the planting to insure proper timing of planting, etc.

A. Cooperator Reimbursement For Refuge Farming

Cooperators will be reimbursed for producing the refuge crops and for other various refuge farming activities, such as crops planted in moist soil areas, by grain from the refuge share of harvested crops. This value will be equal to the value of the work done. The value of the work activities is determined by using the annual "Ohio Farm Custom Rate Survey",(Appendix D). This method of determining rates or values, is completely accountable, fully documented and retrievable, and, consequently, will continue to be used in determining the value of the crop planting. The cooperator would be reimbursed through the following method:

1. The cooperator conducts various refuge farming activities as requested.

2. The refuge determines the value of work to be done based upon the current Farm Custom Rate Survey and records it on the Reimbursement Rates For Refuge Farming form (appendix D).

3. The cooperator harvests all soybeans, including the refuge's 1/3 share. The cooperator harvests 3/4 of the corn as per the cooperative farming agreement and leaves the remaining 1/4 standing in the field. Refuge personnel will generally mow this as desired during the winter and spring months.

4. The cooperator delivers the refuge's share of soybeans to a pre-determined elevator.

5. Upon receipt of bills, the refuges notifies the elevator of the dollar value of soybeans to paid to each individual cooperator for the agreed upon work.

6. The remaining soybeans are inter-elevator transferred or sold to the elevator and the check deposited into the U.S. Treasury, after deducting any remaining refuge costs to the elevator for drying, grain storage, etc.

This method is fair and equitable to both the cooperator and refuge as the refuge always pays the exact amount owed for refuge farming activities, no more or no less. In addition, the cooperator always receives an equitable return for his investment. If actual crop shares were required for conducting refuge activities, then either party could be short-changed, depending upon yields for that year and current market prices.

VI. REVISED CROP ROTATIONS-OTHER ACTIVITIES

Conversion to the new crop-share method of doing business will result in revisions to the existing crop rotation system. In addition, resolution of the various "conflicts" and addressing cropland management objectives will also result in minor changes. The following is a discussion of these changes.

A. Green Browse

To provide additional green browse, some of the oats/clover areas may be replaced with a wheat/clover rotation. Under this program, the clover/oats crop will be replaced with a winter wheat/clover rotation. This will be accomplished by aerially seeding winter wheat into standing soybeans in early to mid-September or by drilling wheat following soybean harvest. The following spring, clover will be broadcast or drilled into the wheat. This will accomplish the desired objective for creating increased fall and spring green browse for migrating geese.

The refuge may contract with a cooperator to accomplish this establishment of green browse.

In some cases, this rotation may be accomplished by aerial seeding or drilling of wheat into the soybean stubble as above, but the spring legume crop will not be established. Instead the wheat will be allowed to mature (year 1) and will be disked under in late August to produce a volunteer crop of wheat. A legume will be established in this wheat

the following spring (year 2). This will be followed by corn (year 3) and then soybeans(year 4).

B. Clover Rotation

Harvesting of oats will not be allowed. Instead, oats will be considered strictly as a nurse crop and emphasis placed on clover production. Cooperators will be encouraged to broadcast seed clover directly into soybean stubble in early spring. This practice has been successful at other refuges and resulted in excellent fall stands of clover . However, if the cooperator chooses to plant oats as a nurse crop, he will not be allowed to harvest the crop, but, instead, must chop (mow) the grain to encourage clover growth and reduce competition. This simply means that rotation emphasis will be on nitrogen fixation (and not a cash crop) as it was originally intended. Hopefully, with good clover production, cooperators will be less likely to feel the need for heavy applications of nitrogen.

C. Fall Tillage

Fall tillage can create potential conflicts with refuge objectives and will be allowed only under special conditions. This relates specifically to current machinery and methods leaving little crop residue, increasing the potential for soil erosion and decreasing nitrogen production by clover. Consequently, fall tillage will only be allowed on harvested corn ground or clover fields after November 15th. In addition, only implements that leave a high percentage of the residue on the surface will be allowed, such as the para-plow or subsoiler will be allowed and will be restricted to one pass over the field. These are the only pieces of modern machinery currently in use that leave greater than 70% crop residue on the surface after tillage while still meeting the cooperator's objective of loosening the soil for an improved seedbed the following year.

Generally, fall tillage is not desired on 1st year clover. This will allow optimum clover growth for nitrogen fixation. However, experience has shown that growth following the 2nd year of clover is minimal and subsoiling of para-plowing may be beneficial. Such fall tillage must be planned to eliminate any waterfowl disturbance or any conflict with waterfowl hunting season.

D. Grain Sorghum and Other Small Grains

Small grains such as grain sorghum, buckwheat, wheat, millet, etc. may be substituted for the corn rotation as necessary to meet the needs of the refuge and/or cooperator.

E. Corn as 100% of refuge share

Planting of corn as 100% refuge share will be a regular practice. This will usually be done with the refuge personnel providing some of the soil tillage with a cooperator or contractor doing the planting, fertilizer and herbicide applications, etc. In these cases, certain fields in the corn rotation will be selected as refuge corn. Such fields will be

managed with the refuge managing the crop and assuming the installation costs. Such fields may be prepared by the cooperator with cost reimbursement by from grain from the refuge share of the cropland program, by using refuge personnel and equipment, or by a combination of these two items. As the refuge has no corn planting equipment, all planting will be done via cooperator's. Other operations may include rotary hoeing, plowing, chisel plowing, and other operations that requires special equipment unavailable to the refuge, but which a cooperator may have. Normal disking, dragging, etc can be done with refuge equipment. Some items such as fertilizer and chemical application can be done by the refuge using commercial applicators.

F. No-Till Practices

No-Till practices will generally be encouraged, but not required. No-Till practices in this area rely to a great extent on herbicides which may not be available on the general pre-approved refuge list. Many of the current herbicides used for no-till in this area are restricted use or atrazine based, especially for corn, thus eliminating them from refuge use. No-till practices under the refuge guidelines becomes much more expensive than conventional tillage. Even on surrounding private lands, no-till practices are often used as a method of getting crops in during dry or wet weather, rather than viewing it as a conservation practice. Thus, it is much more prevalent during bad weather years that in years where weather allows tillage under normal conventional means.

G. Herbicide and Fertilizer Management

The following will be implemented to hopefully move the refuge towards reduced chemical usage:

1) No fall application of fertilizer will be allowed.

2) No anhydrous ammonia will be allowed beginning in 1992, only liquid fertilizer. Liquid fertilizer is considerably less toxic to soil microorganisms and is slightly more expensive than anhydrous ammonia. This may be an incentive for cooperators to be more efficient.

3) A maximum of up to 100 pounds of liquid nitrogen per acre can be applied and only if soil tests show that additional nitrogen is required for the production of the corn crop. Current research has indicated that nitrogen is to be applied at the rate of 1 pound for each bushel of yield desired. Thus, soil tests should indicate the amount of the nitrogen that was produced by the previous clover crop and the amount still needed. Such soil tests should be conducted after planting. Equipment is now available that allows applications of liquid nitrogen even after the crop is up.

5) Post-emergent and banding applications of fertilizer will be encouraged as this increases the potential for immediate plant use and decreased leaching.

6) Pre-emergent herbicides will be discouraged and post-emergent use emphasized.

This will decrease the change for leaching, encourage use of herbicides for targeted pests (the IPM approach) only, and prevent broad-spectrum use of herbicides.

Time of Planting

The planting of crops can be a crucial aspect in the success or failure of the crop.

Planting of the oats/clover crop should occur as soon as possible in the spring, generally before April 15th. Freezing and thawing weather of the fall, winter, and spring months leaves the ground surface of soybean stubble fields extremely loose and workable, with good moisture levels. A oats/clover crop can often be drilled or broadcast directly into the soybean stubble without additional seedbed preparation.

Delay of the planting will result in the ground becoming packed and hardened by additional spring rains, sprouting of spring weeds, etc. Later planting will require additional work in disking and seedbed preparation before planting and increase the costs in terms of manpower, fuel, etc. as well a much shorter growing season for the clover plants which in turn decrease nitrogen replenishment.

Corn should be planted from May 15-May 25th, whenever possible. Although the last acceptable date is June 10th, according to OSU extension guidelines, earlier planting is usually desired. Planting during the above dates will generally be after the cool spring weather, but still take advantage of the May rains. Good soil moisture and increasing temperatures should give good germination and growth.

Earlier planting increases the risk of cool spring weather which leads to poor germination, seed rotting, root rotting, and poor plant growth. Later planting often leads to hotter, dryer conditions which can also give poor or uneven germination and increases the risk of small plants not having enough moisture to grow during the hot, dry weather of late June and July.

Sorghum is similar to corn, but can be planted somewhat later because it is more drought resistant and is better able to cope with the summer weather. Planting should be from May 25th to June 10th.

Soybeans are almost always the prime crop of the cooperator and under his responsibility. Time of planting is usually up to the cooperator. Soybeans in this area are usually planted from May 15th to June 15th. The last acceptable date is June 20th. Earlier planting is usually desired on the refuge to allow for harvest before the hunting seasons.

As wheat is intended primarily for a fall green browse crop for goose use, early planting is important. Generally, a late August planting is desired. Planting dates should be between August 15th and Sept. 5th.

Weed Control:

Weed control in cropland is of prime importance in obtaining adequate yields. Refuge croplands should be managed to rely on mechanical control as the primary means of weed control, with chemicals only used to supplement this mechanical controls.

Weeds in the oats/clover rotation will be primarily controlled by mowing or clipping of the oats in the late June-August period. This will control the weeds as well as allow full development of the underlying clover. Problems areas of Canada thistle may be sprayed with a 2,4D product. This will also kill the clover and should be limited to pure stands of thistle where clover is probably not present anyway. Drift will have to be controlled very closely.

Weed control in corn will usually be by both mechanical and chemical means. Weed control will usually start with good seedbed preparation. If possible, seedbeds should be prepared 7-12 days before planting. Weeds can then germinate and be controlled in the final disking and dragging before planting. Many small weeds can be killed by dragging the field approximately 5-7 days after planting and just before the plant breaks the surface of the soil. Rotary hoeing can be done after the plant emerges and up to a plant height of 2-3 inches. Row plants can be further cultivated with row type cultivators up to a plant height of 18-24 inches. Proper application of these above mechanical techniques can often eliminate or at least reduce the need for chemical controls.

Chemical controls will often be needed to supplement the mechanical controls. Weed control in corn must be directed at both annual grasses and broadleaf weeds, such as foxtail, ragweed, cocklebur, velvetleaf, etc. Chemicals are most often applied by commercial applicators although some cooperators may prefer to apply their own. Specific chemical needed for the program will change from year to year and require annual decisions in the selection of chemicals. Commercial applicators can usually provide the best source of information concerning various options for herbicide use. In recent years, Prowl was applied as a pre-emergent spray for grasses and a 2,4D or dicamba product applied as a postemergent band spray for broadleaf weeds.

Weed control in row-planted sorghum is very similar to that of the corn program. Drilled sorghum cannot have any post-emergent cultivation. Post emergent spraying is possible, although some crop damage would be expected. This would be acceptable if the weed problem is severe. However, weed control in drilled sorghum is usually less of a problem due the close spacing of the sorghum plants, especially if good early growth of the sorghum occurs. With proper seedbed preparation, pre-emergent dragging, and/or rotary hoe application at early stages can often eliminate all chemical control.

Weed control in soybeans uses the same mechanical means as corn and sorghum and a wider selection of chemicals is usually available. Although weed control of the soybeans is the responsibility of the cooperator, mechanical control should be encouraged as much as possible.

Refuge Force Account Activities

Following is a list of refuge force account activities that should be planned in the cropland program each year. Acreage given are the approximate expected acreage to be prepared by refuge force-account and the staff-hours needed for the task.

Date	Activity
Jan. 15-Feb 28	Periodically mow all remaining standing corn and sorghum as necessary for waterfowl use. - 50 to 100 acres, 15-25 staff-hours.

Apr 1 -Apr 15	Drill oats/clover directly into bean stubble or broadcast and drag. Drill clover into green wheat areas where desired. 60 acres - 30 hours
Apr 15-Apr 30	Disc remaining soybean stubble once or twice, then drill oats/clover. 60 acres - 50 hours
May 1-15th	Prepare refuge planted corn and sorghum ground for planting by moldboard plowing, heavy disking, etc. Apply fertilizers. 50 acres - 50 hours
May 15-May 25	Disk and drag corn and sorghum ground just prior to planting by cooperator. Drill sorghum fields. Drag fields approximately 5 days after planting. 50 acres - 20 hours
July 1 - Aug 1	Mow oats/clover or wheat/clover fields - 100 acres - 25 hours.
	With assistance by state personnel, maintain goose hunting fields as necessary by disking, plowing, etc. to maintain wheat areas weed free and fallow. - 75 acres - 30 hours
Aug 15 -Sept 1	Prepare and drill wheat into the goose hunting fields. Clover fields should be subsoiled at this time to increase water intake during the winter and spring months. 50 acres - 20 hours

Approximately 200-250 staff-hours may be required by the program each year. Some of the work in the hunting blind area may be done by state personnel in connection with the management of the hunting program. During the spring planting period, time is critical and sufficient work efforts must be made to insure the crops are planted as scheduled. Much of the above work, approximately 150-170 hours, falls within a narrow window of time from April 15th to May 15th. In order to have a good cropland program, we must commit our personnel resources to the croplands at this time and provide at least 2-3 personnel to establishing these crops if it cannot be accomplished by contract or cooperator.

Fall & Winter Flooding:

The potential exists for increasing temporary wetlands in several cropland units exists. These would primarily be small areas that could retain water during the cold and wet winter months and very early spring periods. Some may have the potential to retain runoff during the fall period where croplands could be flooded to make excellent waterfowl feeding areas.

Most of the areas are tiled and would not hold water into the late spring or summer and could not be considered permanent wetlands. Properly designed and managed, they would not conflict with the current cropland management and could enhance the croplands for use by waterfowl. Properly done, they could even improve the cropland areas. However, if improperly designed and managed, they could eliminate the areas and nearby areas for cropland use, could create heavy vegetation of solid cattail and willow areas, and potentially create flooding of nearby private land and related problems.

To be able to implement this on an area, the area would have to have the following criteria:

1. The area would have to be a depression or low area in a field.

2. The area would have to have no tile drainage or be primarily drained through a tile system that will exit through a single main tile. Areas that are drained through systems where each individual tile exits separately will not generally work unless the ditch that these tile exit into can be controlled and flooded. There are no known areas on the refuge that are not tiled in some way.

3. The area must be capable of having its surface drainage improved so that surface water can be drained quickly and efficiently in the spring. Tile drainage must be adequate to allow efficient subsurface drainage.

4. The areas must have an area where drainage can be blocked in such a manner to be able to flood the area with runoff or in some cases via pumping.

5. Potential areas are shown in purple on the following page.

Construction of these areas would start with providing good drainage via construction small drainage ditches to adequately drain the area when desired. Some of the ditch simply consist of running the grader over the area immediately after the last crop is to insure good drainage and is also a necessary step in good cropland management. Larger ditches would actually consist of grass waterways. The next step would to install some type of structure that would retain the water in these ditches and in the drained area. These ditches in some cases could also be used to carry pumped water to the area for flooding. The final step would be to locate any main tiles lines that are draining the areas and install some type of control structure.

Management of the areas would be aimed at providing flooded areas during the late fall, winter, and early spring months, typically from November through late March. Earlier fall flooding could sometimes be done via pumping. Flooding would also be aimed at those areas where flooding would not conflict with the next years cropland management, etc. and/or where flooding would not harm any existing crop, such as a legume crop. The primary areas flooded would be cornfields, either harvested or unharvested, and to a lessor extent, soybean fields. Generally, areas in clover or other legumes, wheat, etc would not be flooded as flooding would either destroy the legume itself and/or would leach the desired nitrogen from the soils and require replacement with commercial inorganic fertilizers for the production of the next years corn crop. More flexibility would be available in cropland areas that are farmed via refuge personnel than in the areas that are cooperative farmed.

Flooding would occur as early as possible in the fall period. If cooperative farmed areas, flooding would be immediately after harvest which may not be until December in some years. In refuge farmed areas, flooding could occur as early as September or October. In some cases, flooding could be done via pumps. In others areas, flooding would be dependent on rainfall or melting snow.

Drainage would generally be done so that the areas could still be tilled and planted to traditional crops. With improved drainage, this could be as late as mid-April. In areas of poor drainage, drainage may have to start in mid-February, especially where cooperative farmers are used.

VIII. COOPERATIVE AGREEMENTS

Cooperative Farming Agreements (Agreement) are the preferred method of conducting crop-share farming and offer the cooperator some stability and security when issued for periods longer than one farming season.

Consequently, the new crop-share system will be handled under Agreements issued for three years; beginning January 1 and ending December 31, three years later. This will alleviate the potential of conducting field work not included in the existing permit and will give some sense of longevity to the cooperator, which, in turn, will hopefully be incentive to do a better job. Normally, the Agreement will be issued from during the winter (Dec-Feb) of its first year and will outline the crop rotation, shares, etc for the next three years. Annual amendments may need to be sent as changes occur. Specific conditions contained in the Agreement will include the right of the refuge to reduce cropland acres by 10% annually for priority refuge requirements, and to terminate the agreement immediately should a violation of herbicide, nitrogen, special use condition, or other stipulation, occur.

The following is a schedule of activities for refuge cropland management:

Activity	Dates For Proposed Activity
Determine cropland rotation and acres to be farmed	December in year of Agreement issuance, otherwise in January
Determine pesticide needs and prepare Annual Pesticide Use Proposals (if necessary)	Same as above
Meet individually with cooperators to discuss the farming program	Same as above
Determine value of work conducted for various refuge farming activities	Same as above
Complete and mail cooperative farming agreements or annual amendments. Include special conditions, farm map, approved herbicide list, crop seeding rate recommendations, and equal opportunity clause.	Same as above
Mail Herbicide and Fertilizer Use Maps	April

Mail yield report	August
Revise (if necessary) reimbursement for cooperator's work conducted for various refuge farming activities.	September
Notify cooperators of elevator to deliver refuge grain	September
Notify elevators of amounts to be paid to cooperators for various refuge farming activities	September
Prepare Annual Pesticide Use Report	November-December

The Agreements will include the field-by-field crop rotation for all three years, share ratios, etc. This system will allow us to preplan and set up all normal parameters on the normal cropland units. Work in the moist soil unit or other refuge cropland work can then be planned separately and annually.

COOPERATOR RESPONSIBILITIES:

The cooperator must:

a) Obtain approval for the use of herbicides, pesticides, or fungicides from the Refuge Manager prior to application. No chemicals may be used unless a chemical control proposal has been submitted and approved.

b) Furnish all equipment, labor, fertilizer, all seed except special seed mixes which may not be normally available from normal commercial sources, and other required items for planting of both the cooperator's and refuge share of the crop.

c) Obtain clearance from the Refuge Manager prior to harvesting the crop, except as specified in the cooperative farming agreement, or making any changes in the seeding areas, rates, fertilizer rates, etc.

d) Recognize that the signed Cooperative Farming Agreement is a binding and legal contract and any changes will require the mutual consent of both parties and will be documented by a signed addendum.

CROPLAND UNITS:

Current refuge croplands are located in eleven different farm units. Following is a brief description of each unit:

Unit 2 - This unit contains 139 acres. This unit has been cropped heavily to soybeans in recent years. The unit also contains 4 goose hunting blinds. The soils of this unit are approximately 60% Toledo Silty Clay and 40% Latty Silty Clay. Two fields have been planted to switchgrass, but results are spotty and the fields may be put into a crop rotation later. Drainage in the unit is poor and wet conditions have hampered planting and harvesting as well as crop yields. The unit should be redesigned and grass waterways installed to both improve drainage and to eliminate farming of these low areas.

Unit 6 - This unit contains approximately 38 acres of cropland. Some minor dike work is needed to allow fall flooding of this unit.

Unit 6A - This unit contains 23 acres. Access is limited to travel over the adjacent private land and has not been farmed for several years. It is still included in the cropland program since it still contain a potential for cropland use. Soils in this unit are approximately 80% Toledo Silty Clay and 20% Nappanee Clay Loam.

Unit 9 - This unit now contains 86 acres of cropland, including 13 acres of grass strip. An additional 48 acres was removed from production in 1984 by converting to permanent switchgrass. The unit contains six hunting blinds. Soils in this unit are approximately 50% Toledo Silty Clay and 50% Nappanee Clay Loam.

Unit 10 - This unit contains 60 acres in cropland. Soils are approximately 50% Toledo Silty Clay and 50% Nappanee Clay Loam. The unit contains an additional 20 acres of switchgrass which was planted in the early 1980's.

Unit 11 - This unit now contains approximately 60 acres. The unit was planted to fescues, and/or timothy/clover mixes for a period during the mid 1980's. Approximately 45 acres in currently in croplands with the remainder in fescue grasses.

Unit 12 - This unit now contains 48 acres, some of which planted to a clover plowdown mix. Soils in unit 12 are approximately 70% Toledo Silty Clay and 30% Nappanee Clay Loam. Approximately additional acres are in switchgrass.

Unit 14 - This unit is located in the Woodie's Roost area and formerly contained approximately 60 acres of cropland. Poor dikes, drainage, inoperable pumps, and high lake levels curtailed any farming for the past 10 years, although some of the area has been mowed as goose hunting fields. Approximately 31 acres remains as potential cropland and will be managed as cropland to enhance the goose hunting opportunities of the area.

Unit 15 - This unit contains approximately 28 acres of potential cropland. Like unit 14, the unit has not been cropped for several years due to poor dikes, inoperable pumps, and high lake levels. Much of it

has grown up to willow, cottonwood, and/or dogwood shrubs, although some has been maintained as grassland or wheat for goose hunting fields.

Unit 16 - This unit contains approximately 24 acres of potential cropland. Like unit 14 and 15, the unit has not been cropped for several years due to poor dikes, inoperable pumps, and high lake levels. Some of it has grown up to willow, cottonwood, and/or dogwood shrubs, although most has been maintained as grassland for goose hunting fields.

Summary of Unit Acres:

Unit 2	----	139 acres
Unit 6	----	38 acres
Unit 6A	----	23 acres
Unit 9	----	86 acres
Unit 10	----	60 acres
Unit 11	----	60 acres
Unit 12	----	48 acres
Unit 14	----	31 acres
Unit 15	----	28 acres
Unit 16	----	21 acres
Total		534 acres

Former Farm Units - The refuge formerly farmed units numbered 3, 4, 5, 7, and 8. These units have now been completely converted to moist soil units and/or grassland and no longer contain any land managed as croplands. Some of the former cropland in units 1, 6, 9, 10, 12, and 13 have also been converted to moist soil, wetlands, or grasslands.

Several farm units, especially units 2, unit 6, and unit 16 have potential for conversion to moist soil management or an integrated cropland/moist soil unit. However, considerable investment in additional dikes, rip-rap, etc will be required to allow significant flooding and this management will require additional refuge manpower than the current cooperative farm management program. While these options should be considered in future master plans, these units should be maintained as farm units with the current facilities, manpower and budget limitations, etc.

VIII. MAINTENANCE OF FACILITIES

Managing and maintaining refuge croplands will require the maintenance of facilities such as roads, dike, drainage ditches, and tile systems. Many of the drainage ditches in the current cropland areas have been allowed to fill with silt and sediment because of the lack of maintenance of these facilities. Failure to repair dikes has often increased the siltation rates in these ditches, and failure to clean ditches on a regular basis has allowed the siltation to settle in the tile systems and further reduce the drainage which is necessary for good crop yields and good crop management.

Several of the pumps which were used to maintain drainage have been non-functional for several years and are now deteriorated to the point that they are beyond salvage. Some of these pumps can be replaced by rerouting drainage ditches to other existing pumps. Other pumps sites can still be used with portable pumps. Other pumps are still functional, but replacement should be considered. Proper pump maintenance of existing functional pumps is essential and two of the non-functional pumps or pump sites are still needed and new pumps should be installed in them.

Additional refuge equipment should be acquired for use in the cropland and the moist soil program to replace or enhance existing equipment. A subsoiler or heavy chisel plow could also be used effectively for tillage and to break up the heavy clay soils and provide better drainage. Replacement of the grain drill should be considered in the near future.

XI. MOIST SOIL MANAGEMENT

Preliminary planning for the conversion of approximately 900 acres of croplands into moist soil production units began in 1976 as per a FY-76 annual work plan advice. At that time, Lucas and Ottawa County Soil Conservation Services were contacted and several conferences were held with their staffs as well as with Fish and Wildlife Service Biologist, Gerald Cummings.

These initial plans proposed primarily using existing dikes and operational pumps. Dikes and ditches were improved to utilize water from Lake Erie. By 1979, approximately 700 acres had been converted to form Moist Soil Units 3, 4, 5, 7a, 7b, and 8a. Moist Soil Unit 8b was converted in 1981 and Units 6 is not yet operational, but new dikes under current construction should make it operational within the next year. Unit 7C was removed from the cropland program with the intent of converting it to a moist soil unit, however, it high elevation and the location makes flooding difficult. It has never been flooded and is currently and mixture of annual and perennial weeds and grasses. It is recommended that this unit be put back into the cropland program or converted to a oak woodlot. The locations of the units are shown in Figures 1 and 2.

A three-way concrete pumping station was installed in 1980 to provide both pumping and draining capabilities to 640 acres in Moist Soil Units 3, 4, 5, and 6. However, electricity was not connected until early 1983. The pump station is equipped with a 10,000 gpm axial flow pump powered by a 40 hp vertical hollow shaft electric motor. Included are six water-control gates and intake/discharge tubes. Pumping capacity is over 14 million gallons (4 acre-ft.) in a 24 hour period. The pump was used to flood Moist Soil Units 4 and 5 in the summer of 1983.

In 1989 and 1990, five smaller pumps were replaced with new pumps of approximately 1000-1200 gpm (8"-5hp) and with control structures that will allow the draining and/or flooding of the areas as desired. The pumps affect farm units 2, as well as Moist Soil units 7A&B, 8A, 8B, and the Mini-Marsh. The pump in unit 1 was also rebuilt.

Of the 3163 acres in wetlands, 894 acres are currently in Moist Soil Management as follows:

Table 2. Moist Soil Units

Moist Soil Unit	Number of Acres**
3	212
4	106
5	250
6	72
7a	49
7b	44
8a	47
8b	85
LL	30

Total Units 9 Total Acres 895
Total Managed Acres 823**

** Not all acres within areas can be managed for moist soil production.

Past Farming History

Prior to 1972, close to 2,000 acres were annually under intensive cultivation. But in 1972 and 1973, damage from Lake Erie storms caused damage to many dikes protecting these croplands and extensive flooding occurred. Many of the croplands could no longer be farmed and became silted mud flats with only sparse vegetative cover. It wasn't until 1978-1980 when most of the protective dikes could be repaired. Moist Soil Management of these former croplands was implemented at that time. Table 4 shows the habitat chronology of the Moist Soil Units during the 1961-1983 period.

Current Facilities and Management

Main Moist Soil Pump System:

This pump system consists of a 20"-40hp electric vertical turbine pumps capable of pumping approximately 10,000 gpm and a pump structure and ditches which will allow the draining and/or flooding of MS3, MS4, MS5, and MS6. Water is pumped into or from Crane Creek. Thus, it can be used to manage approximately 650 acres of moist soil units.

Moist Soil Unit 3:

This unit consists of approximately 212 acres. The unit is contained by a dike on each side. Each dike rip-rapped and stabilized as necessary, except possibly for a small section of the south dike in the southeast corner. A water control structure consisting of 36" culverts and a double screw/flapgate structure is located in the northeast corner and allows gravity draining or filling from Crane Creek via Tank Ditch. A second structure consisting of two 24" culverts and screwgates in located in the southeast corner and allows draining or filling from the main moist soil pump system.

Topography of the unit varies the elevation up to 3 feet and the unit needs to be subdivided into smaller units of similar vegetation to allow better management. Two cross dikes are needed to divide the unit into three smaller units.

Management over the past five years has only consisted of summer drawdowns and fall and winter flooding. The unit has not been disturbed or mowed since 1982-83 and considerable willow and cottonwood growth is occurring. Cattails and reed canarygrass are also very predominant in the unit. Disking in 1992 gave partial control of the woody vegetation, but reed canarygrass and cattail problems have increased.

Moist Soil Unit 4:

This unit consists of approximately 106 acres and is relatively flat and consistent in elevation. It is contained by a dike on all sides and each dike is rip-rapped and stabilized as necessary. A water control structure consisting of 36" culverts and a double screw/flapgate structure is located in the northeast corner and allows gravity draining or filling from Crane Creek via Tank Ditch. A second structure consisting of two 24" culverts and screwgates in located in the southeast corner and allows draining or filling from the main moist soil pump system.

The unit was tilled in 1990 by moldboard plowing, disking, and drilling to wheat, buckwheat, or Japanese millet. Management in 1991 consisted of a summer drawdown and fall flooding. An excellent crop of wild millet and smartweeds were produced in 1991.

Reed canarygrass again became dominate in 1992 and 1993. In 1993, the unit received heavy disking to control the grass. Control efforts continued in 1994 and appear to be quite successful.

Moist Soil Unit 5:

This unit consists of approximately 250 acres with a elevation variation of approximately 12-18 inches. A water control structure consisting of 36" culverts and a double screw/flapgate structure is located on the north dike and allows gravity draining or filling from Crane Creek via Tank Ditch. A second structure consisting of a 30" culvert with flapgates on each end is located in the southwest corner and allows draining or filling from the main moist soil pump system.

The unit was covered with heavy brush and small cottonwood trees in 1984 when a program to clear the unit was initiated via mowing, disking, and included farming. Brush was essentially under control and the unit produced excellent moist soil plants during 1985-88. However, construction activities during the 1989-90 period prevented proper flooding and considerable willow regrowth occurred. These willow were mowed in late 1991 and portions disked in 1993 to restore the unit. Reed canarygrass is also becoming a problem. Vegetation control via flooding and/or soil tillage will be required for several years.

Moist Soil Unit 6:

This unit consists of approximately 72 acres. The unit is contained by dikes, however, the dikes were in very poor condition and non-functional. Thus, water levels were controlled by lake levels until presently. Willow growth was predominant even during the early 80's. Lake levels in the fall of 1984 allowed almost all willow and cottonwood growth to be mowed but further control was prevented by high lake levels from 1985 to 1988. During this time, both willow/cottonwood and cattail growth increased.

During 1990 and 1991, both the north and south dikes were rebuilt with the result that beginning in 1992, water level control will be possible. Vegetation control was initiated in 1993 with heavy disking to control cattail and willow. It is anticipated that vegetation control will continue in 1994.

Moist Soil Unit 7A:

This unit consists of 49 acres and is contained by dikes on the north and east, by Krause Road on the south and Stange Road on the west. A water control structure and pump structure is located in the northwest corner. The pump allows both draining and flooding from Crane Creek

via a ditch along Stange Road. A culvert screwgate water control structure is also located on the east dike to allow water control into MS7B.

Moist Soil Unit 7B:

This unit contains 44 acres, however, the southeast corner is higher ground, cannot be flooded, and is permanent grassland. The unit is contained by dikes on the north, west, and a portion of the east side, and by Krause Road on the south side. The west dike which separates this unit and MS7A is in poor condition and needs rebuilding. The east dike also needs rebuilding.

A 18" culvert with screwgate exists in the northwest corner which empties into MS7A. This unit has no separate water control structure or pump and must be drained and flooded through MS7A, which limits its management. An additional 300' ditch and water control structure could be placed in the east dike which would allow water control from the mini-marsh pump located 1/4 mile east of this unit.

Moist Soil Unit 8A:

This unit consists of 47 acres, however, approximately 20 acres in relatively high ground and difficult to flood, although not impossible. The unit is contained with dike on all sides, however, the south dike next to the woods is in very poor condition and needs rebuilding to make it fully functional. The north and east dike is in good condition, but some toe damage has occurred and repairs and rip-rap are needed.

A pump and pump structure is located in the Southwest corner for draining and flooding. A second 3-way structure is desired in the southeast corner to allow water management and transfer between this unit and MS8B and/or Pool 2C. Another structure is needed in the northwest corner to allow Pool 2A to be drained or partially drained via the 8A pump.

Management over the past five years has been largely limited to summer drawdowns and fall and winter flooding. Soil tillage via some farming occurred in 1987 and water was retained well into the summer in 1989. Much of the unit was mowed in the fall of 1991 just prior to flooding. Vegetation in the fall of 1989 consisted of good stands of millet and smartweed.

Moist Soil Unit 8B:

This unit contains approximately 85 acres. It is contained by dikes on all sides. A main ditch runs adjacent to the west and south sides which drains the area through a culvert/screwgate in the northwest corner to a pump near the visitor parking lot in the southeast corner.

Soil tillage last occurred in this unit in 1987 when the unit was disked in the spring. Late spring and early summer drawdowns with fall and winter flooding have occurred annually. Vegetation is diverse and in relatively good condition.

Cropland Rotation

Moist soil management calls for the alternate flooding and draining of lands to encourage the growth of natural vegetation which provide waterfowl food. Primary plants are smartweeds, millet, and other

annual plants which provide the early successional stage to vegetate newly exposed soils. After several years of this management, plants of later successional stages, such as perennial and woody species, emerge and become dominant. As this undesirable growth occurs, rotational cropping using cultivated crops or soil tillage are being considered to control the woody growth and set back the successional stage of a unit.

Ottawa's 900 acres of moist soil units are grouped into nine identifiable units which range in size from 29 acres to 250 acres. These units are drained in the late spring or early summer and allowed to grow up to the natural vegetation through the summer months. It will then be flooded to a depth of 4 to 12 inches from October through April or May to provide accessible food to migrating waterfowl. As a unit reaches later successional stages, waterfowl food production and waterfowl use drops. The unit will then be rotated through a soil tillage or cropland stage to set back the succession. The cultivation of a given Moist Soil Unit would occur every 4 to 6 years on a rotational basis with other moist soil units so only a small portion of the units would be in cropland in any given year. The remaining units would be in a variety of different successional stages. Cropping of the unit in rotation is desirable rather than simple soil tillage as the crop could then be used by waterfowl as an alternative food source while tillage only will result in open water/mud flats or areas with late summer vegetation or immature plants if flooded in the fall. In addition, cropping can be done under cooperative farming permits at much less expense to the refuge while soil tillage only may require work by contract or force-account. Both methods will be used to some degree.

An alternative method to control this vegetation is to maintain flooding of the areas over a 2 to 3 year period. This method is not considered as valuable as it requires a longer period to accomplish the task and requires better dikes than presently exist on some units. Maintenance of dikes is higher as higher water levels and longer periods of flooding tend to erode the dikes to a greater degree. To implement this method to a substantial degree would require large investment in improving dikes by raising elevations and providing additional rip-rap. However, this flooding may be less costly in terms of O & M costs as pumping and other operational costs may be reduced. This method may be used on some units where facilities are designed for higher water levels and were additional summer wetlands are needed to provide a benefit to wildlife.

Most of the smaller units will use the cropland and/or soil tillage to reduce the succession while long-term flooding may be used on the larger units. The methods used may also be determined by the O & M funds available. Long term flooding must be used with care to prevent damage to dikes where rip-rap is lacking. Repairs of such damage may be more costly that the costs incurred with mechanical control or tillage.

Refuge soils are mainly wet most of the year due to the high clay content and the high degree of water storage and plant-nutrient storage and release capability. Toledo silty clay (TO) and Toledo silty clay ponded (TP) comprise the greatest percentage of the soil types in the Moist Soil Units.

One important consideration in planting crops in the existing moist soil units is that many lines of field tile which helped drain the areas under the previous cropland program have been removed, damaged, or are no longer functional. Sheet water may quickly collect and flood many cultivated crops before natural runoff or drainage occurs. Such flooding may reduce yields to the point that a it may not be economically feasible for a cooperator under a normal agreement where the cooperator takes a portion of the crop from the unit. However, this plan will incorporate the rotation of the moist soil units with agreements covering other normal croplands and allow the cooperator to be reimbursed with grain from

the refuge shares or this work will be done with refuge personnel and equipment. This will permit the management and flooding of these units in the fall without interfering with the cooperator's harvest or before complete maturity if desired. This will also allow the cropping of the moist soil units without the use of herbicides needed to increase good yields, but which, if used, may hamper growth of annual and desirable moist soil plants in the following year.

All of these units were under cultivation prior to moist soil conversion. Past crops grown included corn, soybeans, alfalfa, wheat, oats, sorghum, buckwheat, and various cover crops.

Small grains may be possible with extensive dewatering and pumping on most of the units. Such small grains are usually more desirable since they do not require the soil preparation or herbicide use normally associated with row-crops. Buckwheat is more tolerant to wet soils than wheat, oats, rye, or barley and can be planted at a later date than most other crops and thus avoid the wetter months of the year and allow more time for pumping and drying to the unit. Sorghum may be used on units which can be tilled early. If used, it will be drilled as a small grain rather than farmed as a row crop to reduce weed growth and the need for herbicide. In general, herbicides and especially residual herbicides will not be used.

Heavy applications of fertilizers may be used on these crops only if the refuge manager determines that it will provide long term benefits to soil nutrients, rather than to increase immediate crop yields. However, 1984 and 1990 observations of millet and buckwheat crops that were planted without any fertilizer applications indicated that little actual seed production occurred. This may have been due to lack of nutrients or to late planting. Test plots of sorghum did much better. Some fertilizer may be required to obtain a high level of food production.

Although legumes aid crop rotation and increase soil nitrogen with their ability to fix nitrogen, they generally have a longer growth cycle than other crops and would not grow properly or mature in one short summer period. Many are not suited to wet soils. In general, these legumes are not considered for use in the rotational cropping of the Moist Soil Units.

No-till and aerial seeding may be alternatives to traditional farm practices. However, no till farming generally uses increased amounts of herbicides which is undesirable in the moist soil areas. Aerial seeding would reduce the actual soil tillage which is one of the desired objective of the rotation. Without this mechanical tillage, succession may not be reduce to the very early stages, especially without herbicides. Aerial application of heavier seeds such as barley, wheat, or buckwheat onto wetter exposed soils may be conceivable.

Dewatering a moist soil unit early in the spring for cropland use will be one of the biggest problems, especially if funds for pumping are not available. Lake Erie is normally high during the spring and early summer and only limited amounts of water can be discharged by gravity draining. Pumping may be required and many of the small farm pumps were only designed to move small amounts of water that would accumulate by seepage or precipitation.

There may only be enough time before the required planting dates to pump down, dry, and till the higher ends of some units. Farming could occur only in the higher ends of a Moist Soil Unit, although later tillage only may be done on the lower areas which may dry later in the summer. However, the lower areas will normally have an earlier successional vegetative stage and tillage is not as necessary. Large units may have to be left dry through the previous fall to allow rotation the following summer.

Evaluation

Moist soil management with rotational cropping is controlled management which must rely on sound ecological and management principles. These constructed wetlands are only as good as the design and construction of the impoundment, the soil, and the management techniques used on them. Planning is required to involve a group of impoundments to provide maximum diversity of wildlife and production of waterfowl foods on a continual basis by rotating the management of the different Moist Soil Units. Evaluation is necessary to determine the best methods to reduce successional stages and to monitor vegetation and waterfowl use.

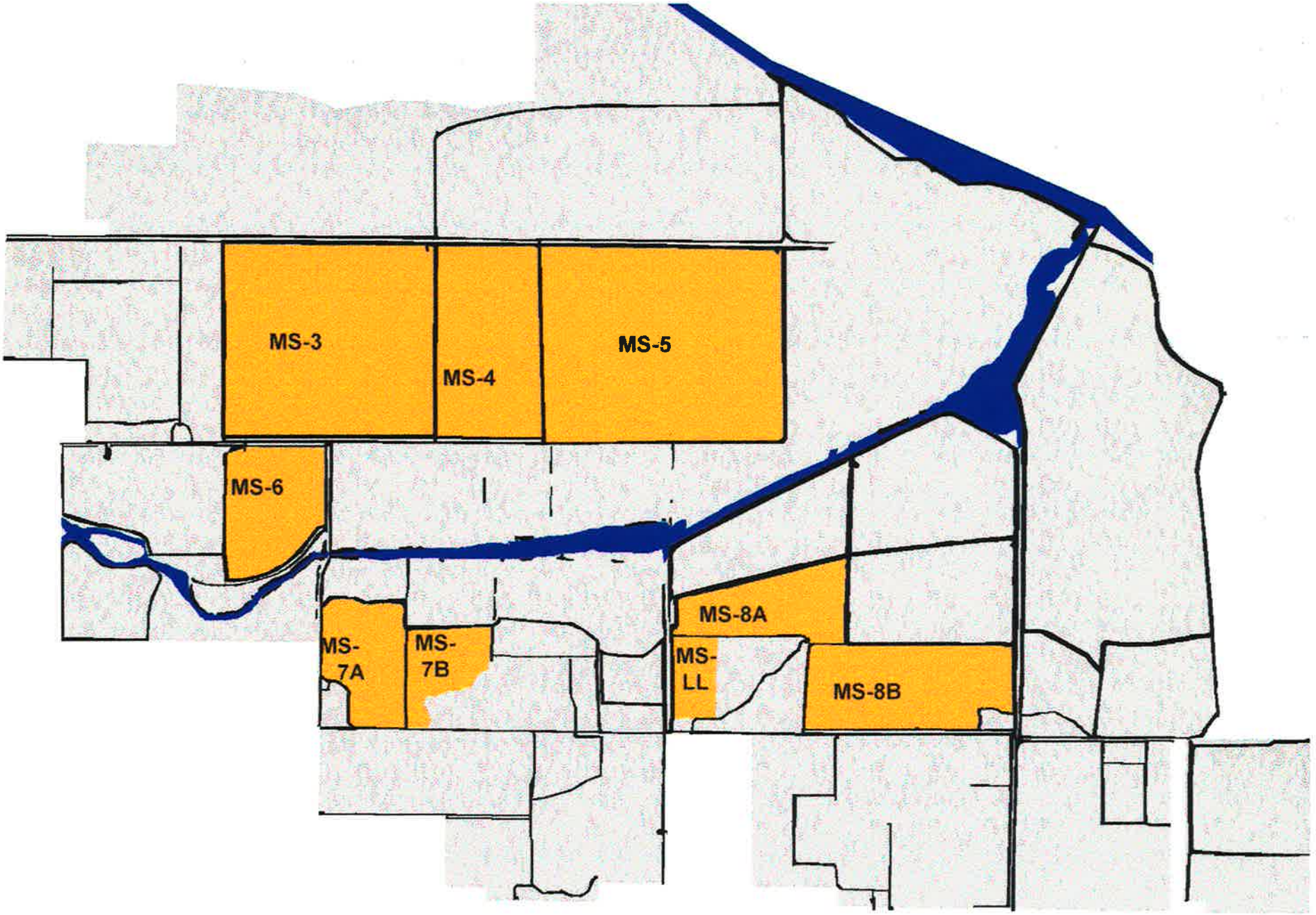
Evaluation of waterfowl use of the individual moist soil units should be done on a periodic basis. Although intensive and detailed surveys and records are desirable, such detail is also costly to collect, store, and analyze. Current refuge funds and manpower will not permit detailed data collection or analysis. Thus, often decisions concerning the amount of waterfowl use, vegetative condition, successional stage, and the annual management techniques are a result of less than ideal observations and the subjective judgement of the refuge management staff.

While complete intensive surveys or long term annual surveys may not be possible, short term studies and informal monitoring of selected units can be beneficial in increasing the knowledge of moist soil management.

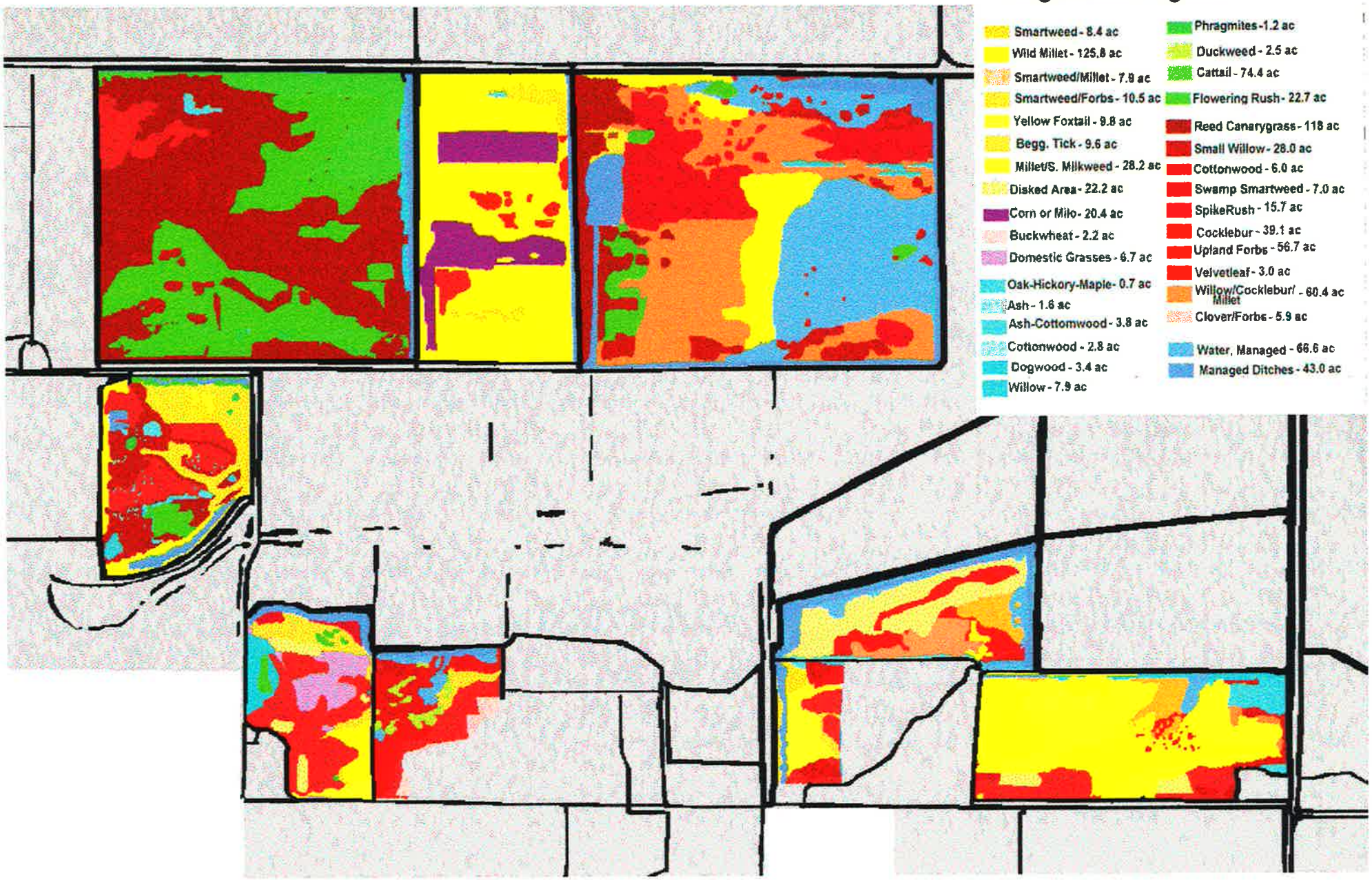
It is recommended that the current waterfowl census techniques be modified to record the waterfowl use on the individual moist soil units over the next 5 years. Such data will be kept as field records only and not be analyzed or tabulated at this time. Such analysis would likely be done only if computer equipment and/or volunteers become available in the future.

Current studies should be done on the vegetative changes and conditions in relation to the management practices. Formal studies by college students and research personnel should be encouraged. Informal studies by refuge personnel will continue to be done.

Ottawa NWR - Moist Soil Management Units



Ottawa NWR - Moist Soil Vegetation - 1994



XII. ALTERNATIVES TO THE CROPLAND PROGRAM

Selected Program: This plan calls for a combination of managing the refuge croplands through the use of cooperative farmers and with force-account farming with the use of refuge personnel. The program calls for maintenance of up to 600 acres for cropland management to support refuge programs. The plan is flexible to allow various combinations of force-account and cooperators implemented croplands as well as various combinations of row crops of corn, milo, and soybeans and other crops including legumes, wheat, buckwheat, etc. It is anticipated that force-account farming will be used to farm from 200-300 acres of the program with the balance being farmed by cooperators.

The following alternative were considered in the writing of this cropland plan:

1. Reduction or Elimination of the Croplands - Complete elimination of the refuge croplands will eliminate a major portion of the potential waterfowls food resources that can be provided by the refuge as well as lower the quality of the hunting program. In addition, we would lose the ability to use the cropland program to manage the moist soil unit through cooperative farmers. Reduction of the cropland program to the amount necessary without using cooperative agreements would support these programs, but would require considerable refuge expense to put in the crops either through contract farming or use of refuge personnel, equipment, and materials to plant and maintain the crops. Any reduction below the above listed levels will require increased refuge expense or decreased quality of the habitat. Some cropland units may have the potential to be converted to moist soil units, but additional dikes, pumps, etc would be required making it more expensive. In addition, these units are generally higher ground areas where more pumping would be required, vegetation control increased, etc., making it economically unfeasible to do this at the present time.

2. Reduction of the row Crops - This alternative will also require substantial reduction of the crops and programs supported by these row crops. The row crops provide the economic incentive for the cooperators to participate in the program. Reductions will mean that the refuge will have to support a the entire share of the crop through contract farming or force-account farming.

3. Reduction of the Cover Crops - This alternative was considered and would require seeding a portion of the present cover crop and cropland areas to permanent grass cover. This would leave less area for cover crops and less area available for rotation. Available cropland would be cropped more heavily. Complete elimination of the cover crops would mean the majority of the remaining croplands would be in continuous row crops.

4. Reduction in the amount of moist soil acreage supported by the cropland program - Under the proposed program, only 50-75 acres of the moist soil units will be farmed by cooperative farmers. If all 900 acres of the moist soil units are rotated on a 5 year rotation, approximately 150-180 acres will farmed or tilled annually. Under this program, approximately 50-75 acres will be farmed by cooperators and refuge personnel will be tilling the remaining acreage. Reduction of moist soil areas rotated will

allow less row crops, but increase refuge expense in rotating or tilling the moist soil areas.

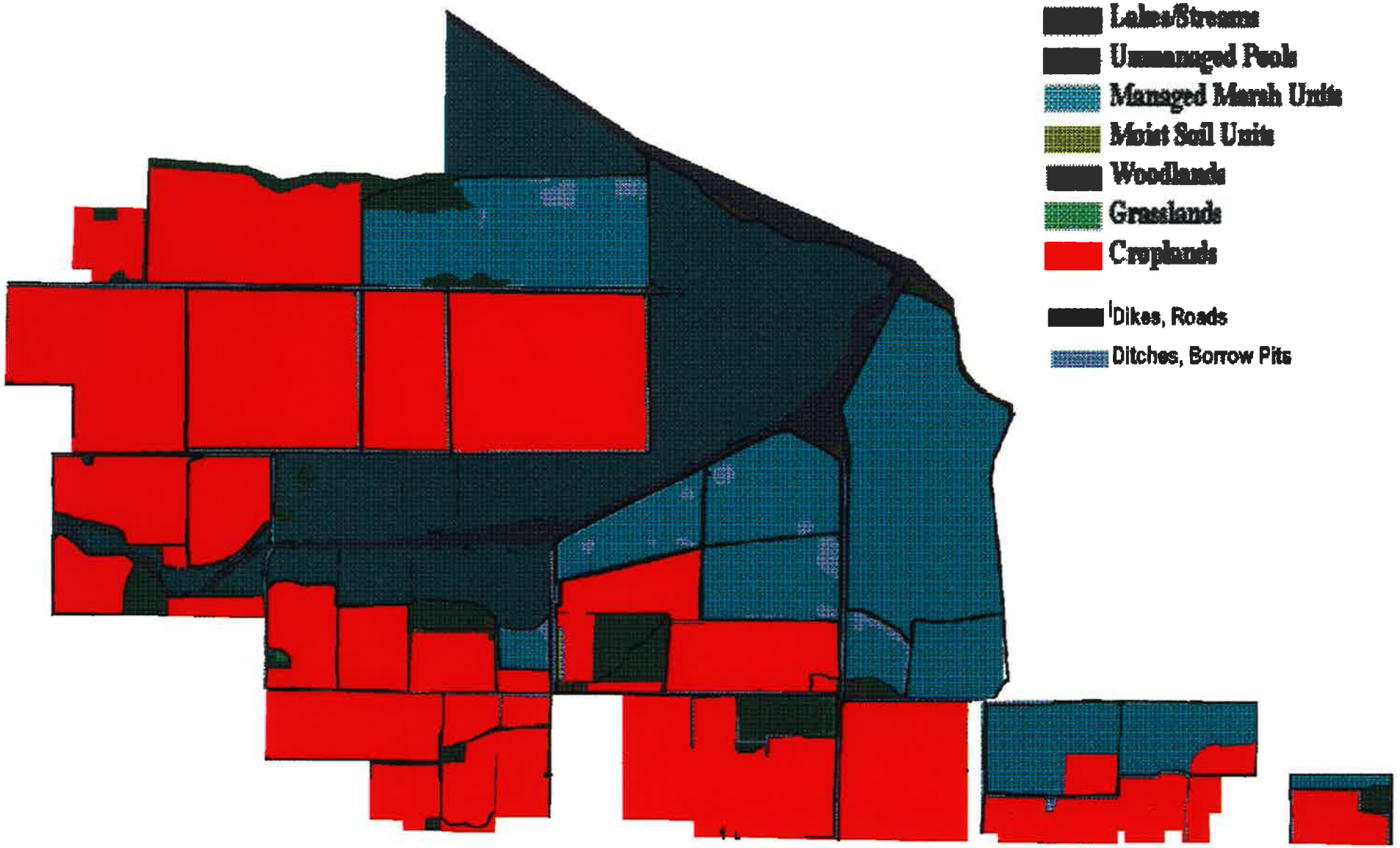
5. Elimination of the croplands supporting the hunting program - Approximately 30-40 acres of the proposed and current program is primarily to support the goose hunting program. Elimination of this portion of the cropland program could be done by simply converting the hunting areas to permanent grass cover that would be mowed prior to the hunting season each year. This would reduce the quality of the hunting and reduce hunter success. Maintenance of the grasslands and the annual mowing could cost more in terms of refuge cost and manpower than to farm the same areas under cooperative agreements.

6. Expansion of Cropland to more than 600 acres by converting some or all of moist soil units back to cropland production. This alternative would return many of the areas converted from cropland to moist soil units back to the production of row crops. This would favor goose management over duck management and reduce the diversity of waterfowl foods. Much of these areas would have to be force-account farmed in order to allow fall flooding for maximum waterfowl use. Such fall flooding of row crop areas is more detrimental to soil resources that similar flooding of moist soil units as ground cover is much less and more soil and soil nutrient loss is expected. In addition, refuge costs will be much higher to the degree that refuge budgets could not support the program. It simply would not support the diversity and amount of waterfowl use that can be provided under the preferred alternative.

Appendices

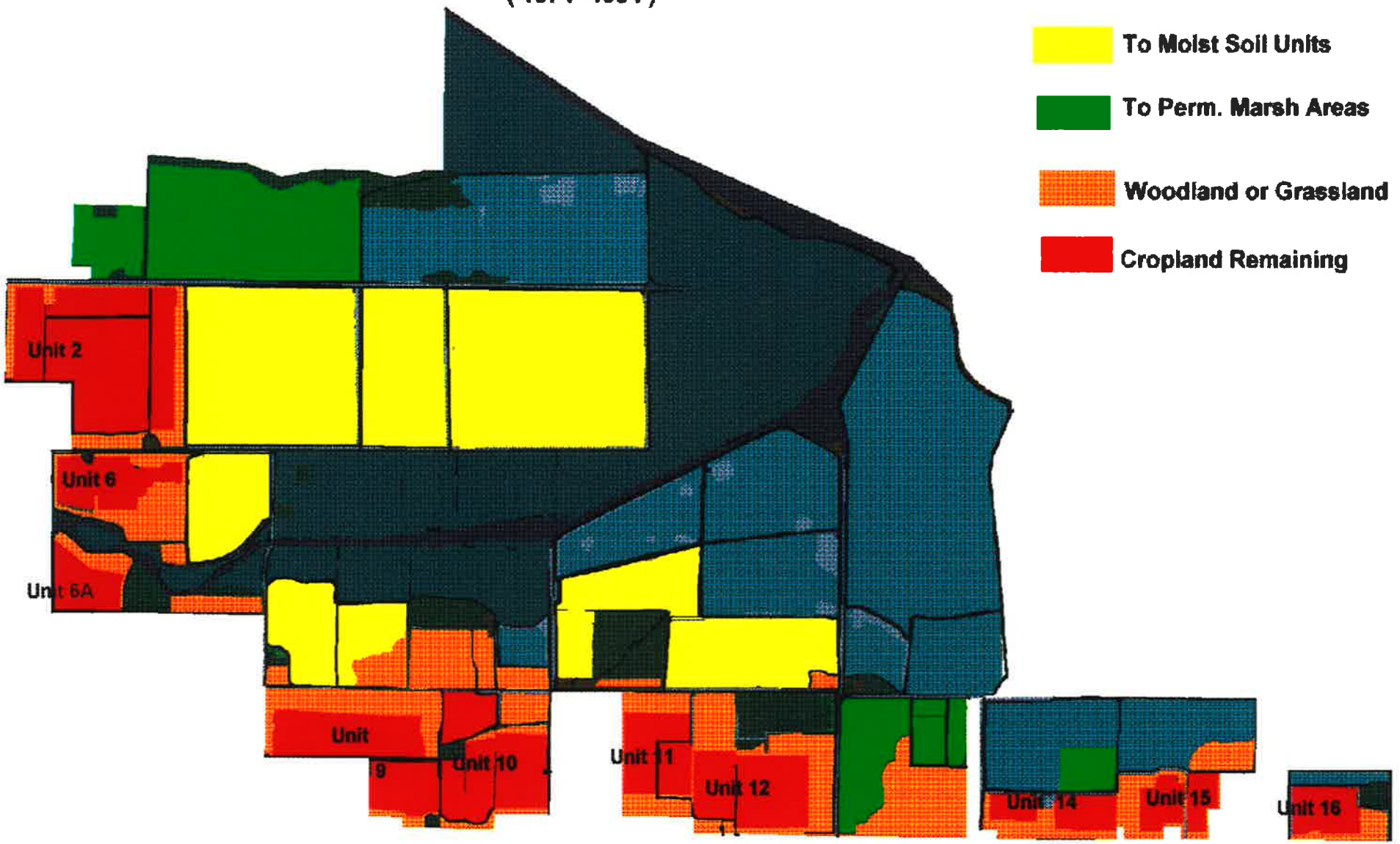
Appendix A. Former and Current Cropland Areas

Ottawa NWR - Croplands before 1972 - 1900 acres

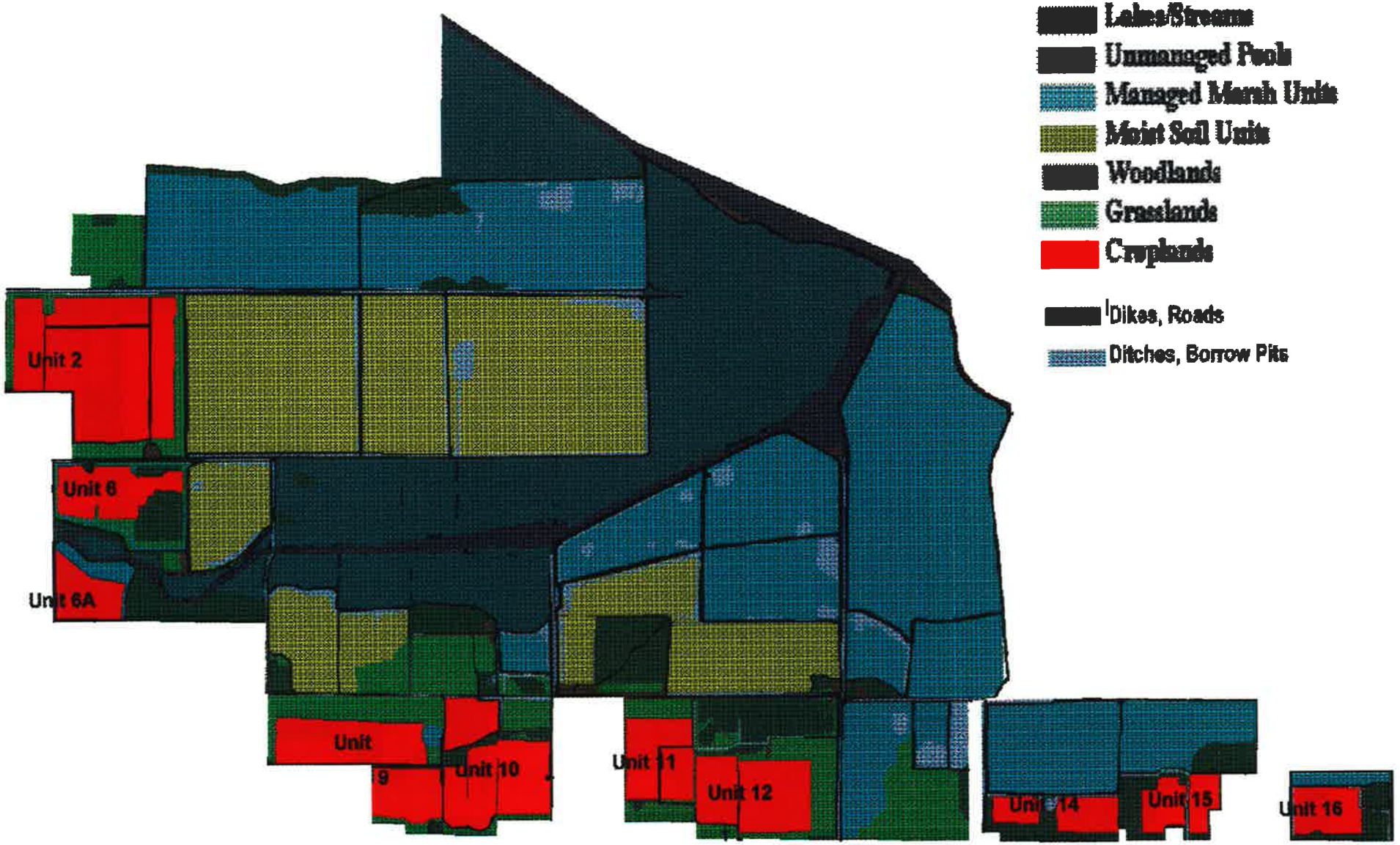


Ottawa NWR - Croplands Converted to Other Habitats

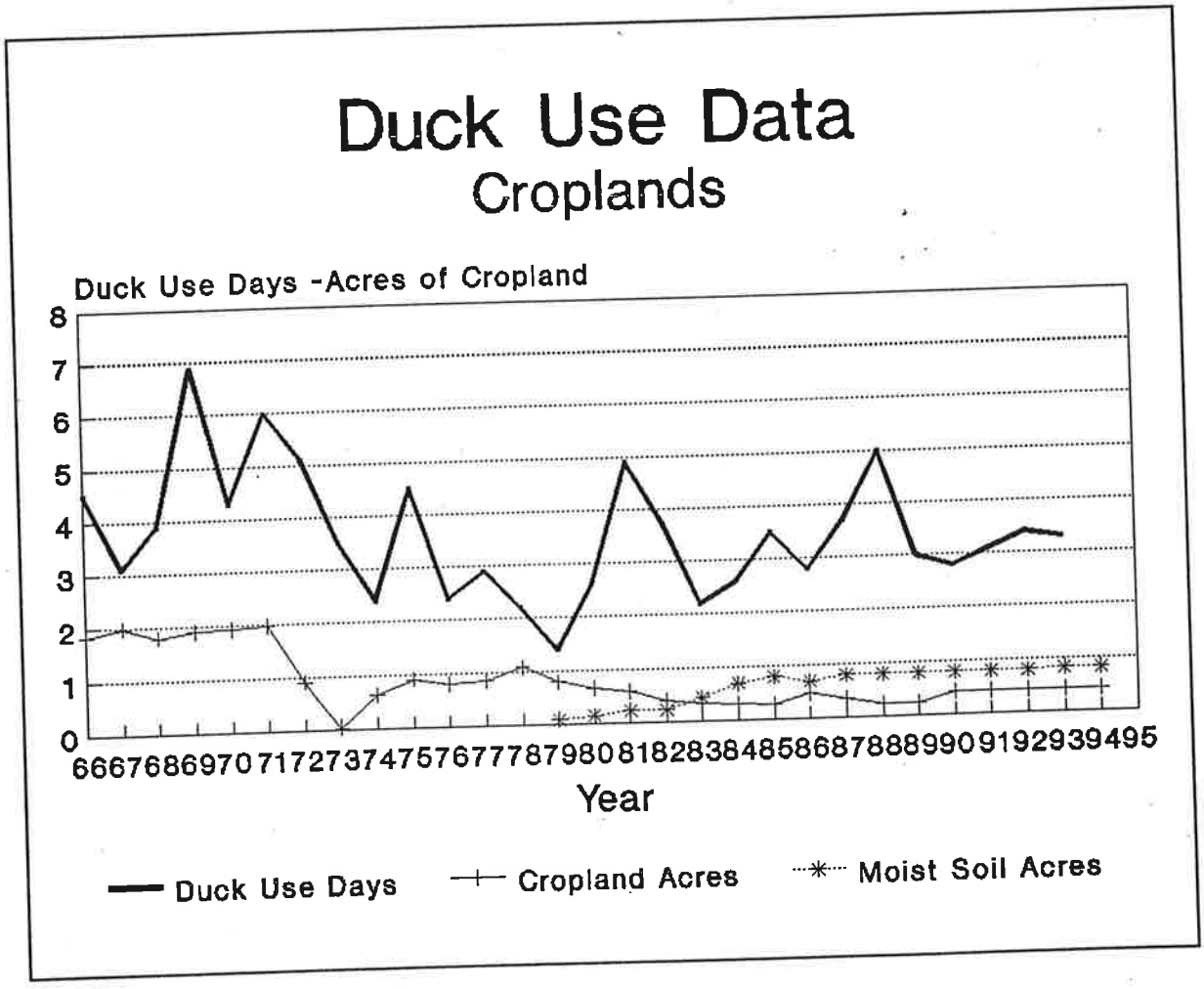
(1974--1994)



Ottawa NWR - Current Cropland Units - 1994



Appendix B. Duck and Goose Use and Cropland Acres



Goose Use Data
Croplands

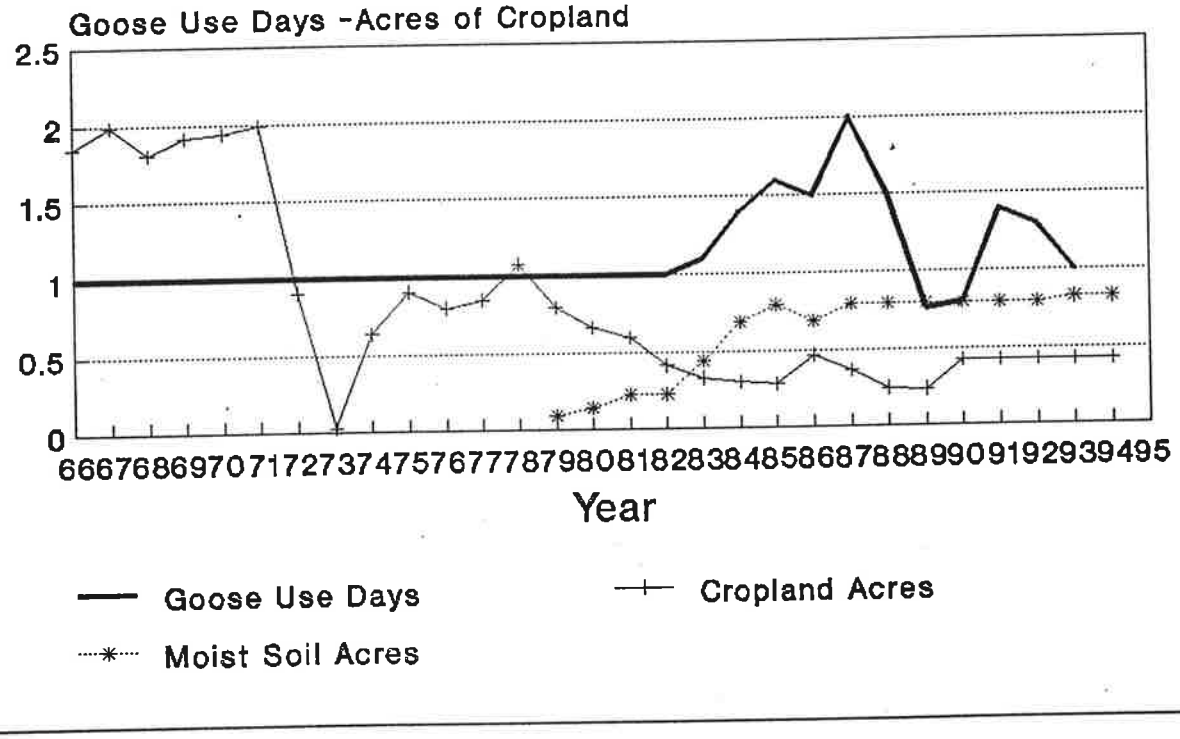


Table . Cropland Acres and Duck Use

Year	Goose Use Days (millions)	Duck Use Days (millions)	Acres of Croplands	Acres of Moist Soil
1966	.39	4.5	1847	0
1967	.50	3.1	1992	0
1968	.91	3.9	1807	0
1969	1.47	6.9	1917	0
1970	1.34	4.3	1939	0
1971	2.02	6.0	1990	0
1972	2.40	5.1	904	0
1973	1.93	3.5	29	0
1974	1.50	2.4	638	0
1975	2.00	4.5	905	0
1976	1.24	2.4	797	0
1977	1.04	2.9	845	0
1978	1.80	2.2	1078	0
1979	1.50	1.4	794	93
1980	1.90	2.6	659	140
1981	1.60	4.9	594	225
1982	2.10	3.7	410	225
1983	1.10	2.2	326	437
1984	1.40	2.6	298	687
1985	1.60	3.5	282	793
1986	1.50	2.8	467	687
1987	2.00	3.7	362	793
1988	1.50	5.0	243	793
1989	0.76	3.0	236	793
1990	0.80	2.8	420	793
1991	1.40	3.1	420	793
1992	1.30	3.4	420	793
1993	1.00	3.3	420	823
1994			420	823

Appendix C. Cropland Program Facilities

Part I. Following is a listing of the real property facilities which directly support the cropland program.

Unit 2	0.5 mile of protective dike 139 acres of tile system 1.7 mile field road 0.58 mile drainage ditch 1 pump structure with 8"-5hp electric vertical turbine pump 1 pump structure with 3" submersible pump
Unit 6	48 acres of tile system 1.7 mile drainage ditch 0.44 mile protective dike (Crane Creek) 0.94 mile small dike (private land, MS6, county line road)
Unit 6A	0.38 mile of drainage ditch 0.66 mile of protective dike 30 acres on tile system
Unit 9	0.60 mile of drainage ditch 0.60 miles of field road 130 acres tile system (includes switchgrass area) 1 pump structure with 8"-5 hp electric vertical turbine pump
Unit 10	0.75 mile of protective dike 0.75 mile of drainage ditch 90 acres of tile system(includes switchgrass areas)
Unit 11	0.75 mile of drainage ditch 0.75 miles of field road 60 acres of tile system
Unit 12	0.85 mile of drainage ditch .50 miles of field road 70 acres on tile system (includes grassland areas) 1 pump structure with 8"-5 hp electric vertical turbine pump This pump also serves unit 11.
Unit 14	30 acres of tile system 0.66 mile of drainage ditch 1 pump structure with 8"-5 hp electric vertical turbine pump(currently non-functional), but with existing electric service.
Unit 15	30 acres of tile system 0.66 mile of drainage ditch

(Old pump in unit 14 also served this unit.

Unit 16 — 30 acres of tile system
0.72 mile of drainage ditch
one old non-functional pump site with existing electric service.

Part 2. Needed Facility Improvements for the Program

In order to fully implement this plan, a number of improvements are still needed to properly manage the cropland units. These are listed below and shown on the following maps.

Unit 2 ---
Build up field roads. Several field roads need to be built up in the unit to allow better field access. Install grass waterway/drainage areas. Improve drainage ditches to better drain some of the low areas and install water control structures and ditch plugs to provide for fall and winter flooding*.

Unit 6 ---
Some dike improvement needs to be done on the south and west sides to improve the dike to hold water and prevent flooding of private lands. Once completed, some of this unit may be fall and winter flooded.

Unit 9 and 10---
Maintain and improve field roads.

Unit 11 ---
Maintain and improve field roads.

Unit 12 ---

Unit 14 ---
This unit will require the installation of a culvert/screwgate in the northwest corner, the rehab or replacement of the old pump in the northwest corner, and the maintenance of approximately 2500 feet of ditches. Some runoff water from private land drains into this unit and this may be routed to another location to avoid flooding problems and excessive pumping. Electrical service to the pump site still exists and could be reactivated.

Unit 15 ---
Several ditches (2500') need to be maintained and a ditch crossing needs to be installed.

Unit 16 ---
Ditches around the farm fields need to be rehabed (3500') and a pump site needs to be rehabed. Electrical service to the pump site still exists and could be reactivated.

Summary: A total of 6 miles ditches will require maintenance to maintain and enhance the cropland program. Approximately 1500 feet of protective dike needs to be rebuilt and two non-functional pumps need to be replaced or rehabilitated. Two water control structures need to be installed.

Appendix D. Farm Custom Rates in Ohio

L-74
ESO-1955
AGDEX 825

Farm Custom Rates Paid in Ohio, 1991*

Richard D. Duvick
Department of Agricultural Economics and Rural Sociology
Ohio Agricultural Research and Development Center
Ohio Cooperative Extension Service
The Ohio State University

Operation	Unit	Rate	
		Typical	Range
Soil Preparation			
Stalk Chopping	acre	$ 8.00	$ 4.00-10.00
Plow	acre	12.00	5.00-16.00
Disk Plow	acre	10.00	8.00-12.00
Chisel Plow	acre	10.00	8.00-13.00
Drag	acre	6.00	3.50- 8.00
Disk	acre	7.75	3.50-12.00
Disk and Drag or Harrow	acre	9.00	5.00-12.00
Harrow	acre	6.00	4.00-10.00
Rotary Hoe	acre	5.00	3.00- 8.00
Cultivation	acre	6.50	5.00- 9.00
Planting			
(Cost of seed or materials not included)			
Corn or Soybeans			
Row Planter			
Conventional			
Seed Only	acre	10.00	4.00-20.00
Seed and Fertilizer	acre	11.00	6.00-20.00
Seed, Fertilizer and Chemicals	acre	13.00	8.00-20.00
No Till			
Seed Only	acre	12.00	6.00-20.00
Seed and Fertilizer	acre	14.00	7.00-20.00
Seed, Fertilizer and Chemicals	acre	15.00	9.00-20.00
Soybeans			
Drill			
Seed Only (7")	acre	12.00	6.00-20.00
Seed Only (10")	acre	9.00	7.00-15.00
Seed and Fertilizer (7")	acre	12.00	7.00-15.00

*Reported for the 1991 year.

The cooperation and assistance of farmers and county agricultural extension agents is most appreciated.

Operation	Unit	Rate Typical	Rate Range
Planting (cont.)			
Small Grains			
Drill			
Grain Only	acre	$10.00	$ 4.50-20.00
Grain and Fertilizer	acre	10.00	7.00-17.00
Grain and Grass Seed	acre	10.00	8.00-16.00
Grass Seed			
Grain Drill	acre	10.00	6.00-16.00
Packwheel Drill	acre	12.00	4.00-16.00
Broadcast	acre	4.00	2.00- 8.00
Sod or Zip Seeder	acre	11.00	4.00-18.00
Application of Fertilizer and Chemicals			
(Cost of seed or materials not included)			
Surface application			
Fertilizer (Labor, Power and Applicator)			
Dry Bulk	acre	3.50	2.00- 7.00
Liquid	acre	4.00	3.00- 5.50
Anhydrous	acre	8.00	3.00-12.00
Lime	acre	5.00	1.00-10.00
Chemicals (Weed, or Pest Control)			
Spraying Ground	acre	4.00	2.00- 7.50
Aerial Application	acre	6.00	4.50- 7.50
Grain Harvest*			
Combine			
Small Grain	acre	20.00	16.00-26.00
Soybeans	acre	20.00	16.00-26.00
Corn	acre	20.00	12.00-26.00
Corn Picker	acre	18.00	10.00-25.00

* Typically furnished 1 man, 1 tractor, 2 or3 wagons, 1 or 2 trucks and hauled grain 9 miles or less.

Hay Harvest			
Mowing	acre	7.00	5.00-15.00
Mowing/Conditioning	acre	8.00	6.00-16.00
Raking	acre	5.00	2.00- 8.00
Bale Hay or Straw (40-50#)			
Dropped on Ground	bale	.30	.20- .50
Loaded on Wagon	bale	.35	.20- .60
Haul to Storage (add)	bale	.25	.10- .40
Large Round Bale (700-1,500#)			
Left in Field	bale	6.75	4.00- 8.00
Haul from Field	bale	9.75	8.00-12.00
Move Large Bale or Stack	bale/stack	2.75	1.00- 5.00

Operation	Unit	Rate Typical	Rate Range
Complete Hay Harvest			
(mow, rake, bale, store)			
Hire (1 cutting)	ton	$ 35.00	$16.00- 50.00
Share of Crop	percent	50%	50-67%
Grain Drying			
20 to 14%	bushel	.18	.09- .24
25 to 14%	bushel	.25	.11- .33
Grain Storage			
Initial Take-In Charge plus 1 Mo.	bushel	.06	.04- .20
Take-In Plus 4 Months	bushel	.17	.14- .25
Storage Charge Per Month	bushel	.03	.02- .05
Hauling Grain			
Farm to Market (10-25 mi.)	bushel	.08	.05- .15
Field to Farm	bushel	.05	.02- .10
Tile Installation			
Ditching	foot	.25	.12- .30
Backfilling	foot	.03	.02- .09
Complete Installation			
4" Plastic Tile	foot	.42	.17- 1.00
Hired Labor			
Machinery Operation	hour	6.00	3.50- 12.00
General Labor	hour	5.00	3.00- 10.00
General Farm Labor	month	1,375	375-3000
Other			
Bush Hogging	$/acre	10.00	4.00- 20.00
Building Fence (No materials)	$/hr.	13.50	5.00- 30.00
Grinding Feed	cwt.	.57	.30- .75
Income Tax Preparation	$	180.00	50.00-1750.00
Accounting & Tax Preparation	$	350.00	200.00-2100.00
Custom Farming			
All machinery operations for growing and harvesting			
Corn	acre	67.50	20.00-115.00
Soybeans	acre	70.00	23.00- 90.00
Small Grain	acre	50.00	20.00- 80.00
Equipment Rental			
Tractors (horsepower)			
60-100	hour	15.00	8.00- 25.00
100-150	hour	20.00	10.00- 28.00
150-200	hour	25.00	12 00- 37.00
Combine (20 ft. or 6 row)	acre	15.50	12.00- 20.00
Corn Planter (6 row)	acre	8.00	5.00- 20.00
Grain Drill (14 ft.)	acre	8.00	5.00- 15.00
Bobcat Loader	day	100.00	30.00-275.00

Custom Rates Typically Charged for Selected Operations By Regions, Ohio, 1991

Operation	Unit	State	NW	NE	SW	SE
Plowing	Acre	$10.75	$ 9.25	$11.50	$12.00	$11.50
Disking	Acre	7.75	7.75	7.00	7.75	7.50
Chisel Plow	Acre	9.50	9.50	8.50	9.25	10.00
Chop Stalks	Acre	10.00	9.50	11.00	10.50	9.75
Plant Corn or Beans						
Conventional	Acre	12.00	12.00	13.50	10.50	13.75
No-Till	Acre	13.50	13.00	12.75	12.50	16.00
Baling						
Dropped	Bale	0.30	0.25	0.33	0.32	0.23
Loaded	Bale	0.35	0.30	0.38	0.41	0.33
Large bale, Drop	Bale	6.75	8.00	7.00	6.25	6.00
Combining						
Small Grain	Acre	20.00	18.00	20.00	19.00	19.00
Soybeans	Acre	21.00	19.00	21.50	20.75	22.00
Corn	Acre	21.00	19.00	21.50	21.00	22.00
Pick corn	Acre	17.50	17.50	19.00	20.00	19.00
Machinery Operation	Hour	6.00	6.00	5.75	5.75	5.75
General Labor	Hour	5.50	5.25	5.25	5.50	5.75

Typical Acreage Custom Work Hired or Performed By Respondents, 1991

	Unit	Hired	Performed
Plowing	Acre	41	50
Planting	Acre	68	150
Spraying	Acre	364	300
Fertilize	Acre	300	300
Combine grain	Acre	60	143
Combine corn	Acre	.80	147
Haul grain	Bushel	15,000	10,800
Chop silage	Acres	32	40

6/92 – 10M Revised – 63649

Issued in futherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Keith L. Smith, Director of Ohio Cooperative Extension Service, The Ohio State University.

Appendix E. Cooperative Farming Agreement and Attachments

DEPARTMENT OF THE INTERIOR
U.S. Fish and Wildlife Service

COOPERATIVE FARMING AGREEMENT

Cooperator's name	Address
Period of use From: _____, 19____ To: _____, 19____	Refuge Name and State where located

The U.S. Fish and Wildlife Service, for and in consideration of the mutual benefits arising hereunder, grants to the Cooperator named above, privileges of using lands of the National Wildlife Refuge System indicated above, for the cultivation, production, and/or harvesting of agricultural crops, on a share basis as specified below:

Farm Unit	Field	Crop or Crop Group	Acres	Cooperator's Share (% or acres)	Government's Share (% or acres)	
					Harvested	Unharvested

1. The Cooperator agrees that agricultural crops of the type and acreages specified above must be planted, cultivated, and harvested during the first year of operation. If this agreement is for more than one year, the type of crop, acreage, and distribution may be altered or modified annually, following the first year of operation, by mutual consent of both parties. Changes in the agreement must be made prior to planting season by an addendum, which is attached to and becomes part of the agreement.

2. These privileges are granted by the U.S. Fish and Wildlife Service, and accepted by the undersigned, subject to the terms, convenants, obligations, and reservations contained therein.

3. Special Conditions: (If none, so state)

- -
(Cooperator's Signature)

- -
(Date)

- -
(Issuing Officer's Signature and Title)

- -
(Date)

3-1492 (Rev. 3/78)

SPECIAL USE PERMIT ATTACHMENT

Special Conditions of Cooperative Farming Agreement with:

_____

1. Cooperator to apply all chemical pesticides as per approved pesticide control plans which have been approved by the Refuge Manager and Regional Office. All applications must be in compliance with state and federal laws and per label restrictions.

2. Cooperator to apply fertilizer to refuge cropland, including the refuge portion of all crops as specified by soil tests and all applications must be approved by the refuge manager.

3. Fall plowing, burning of crop residues, removal of crop residues, or the use of mercury treated seed is prohibited, unless specifically authorized on a site specific basis.

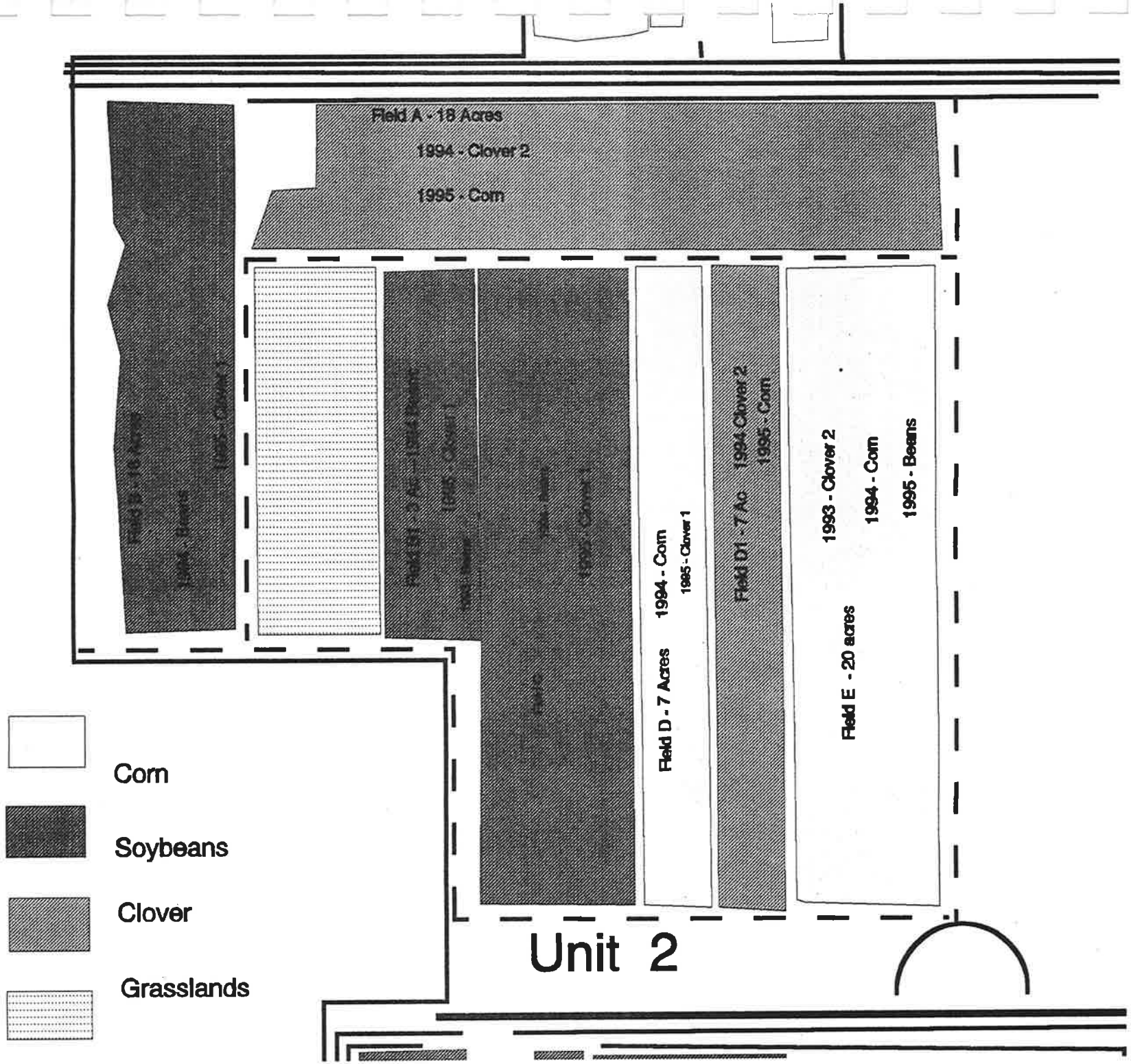
4. Cooperator is to plant and care for refuge share of the crops as he would if he were to harvest them as his own, according to normal agricultural practices used on similar crops in this area.

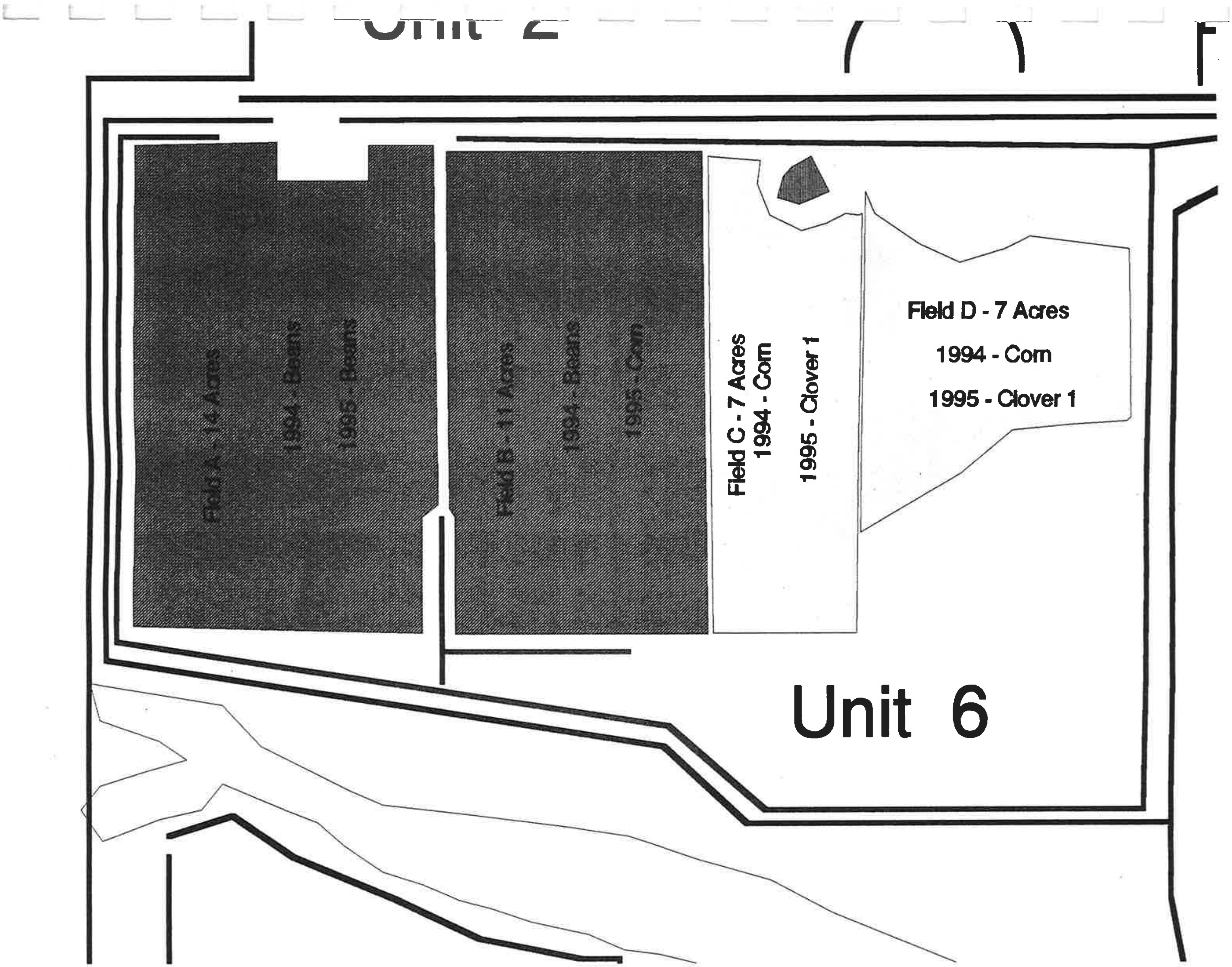
5. Plowdown mix cover crop is to be: 60% Mammoth Clover or Ladino Clover and 40% yellow blossom sweet Clover, to be planted at a rate of 10 lbs/acre.

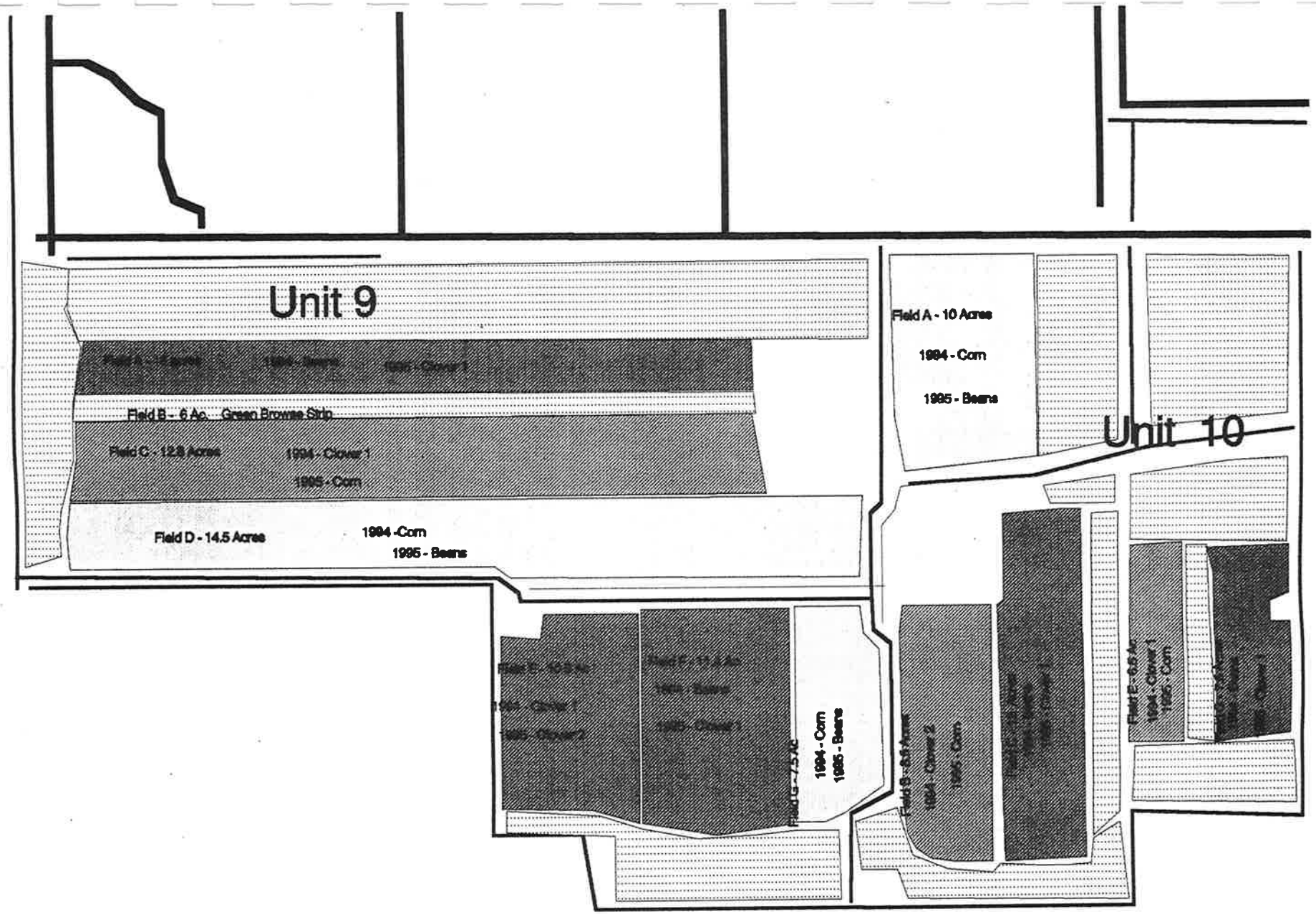
6. Soybeans are to be an early maturing variety and if possible, be harvested by the opening of duck/goose season in mid-October. No harvesting is to be done before noon on days when the refuge is open to goose- hunting.

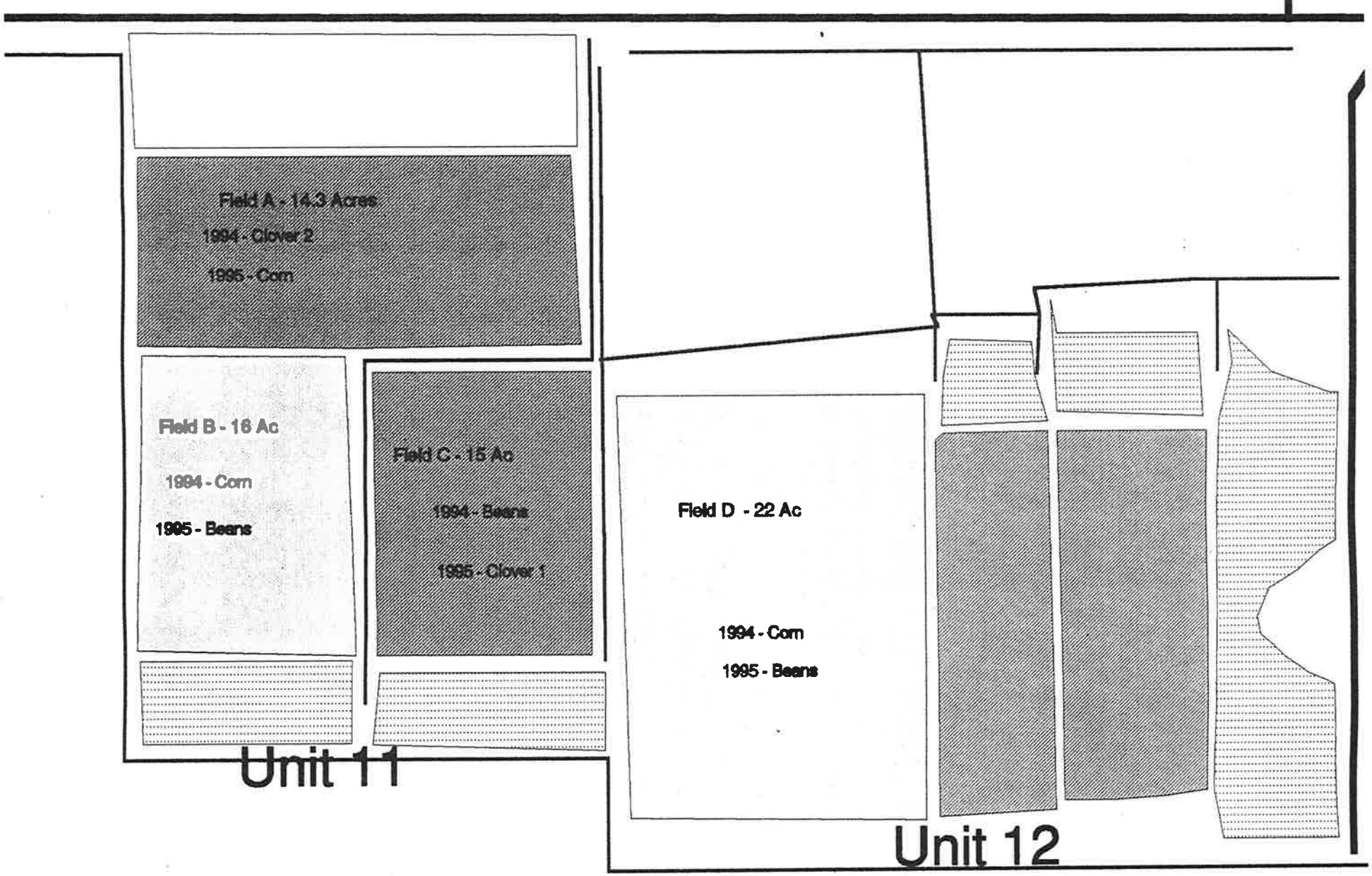
7. Aerial seeding of wheat into soybean fields is to be done by August 30th.

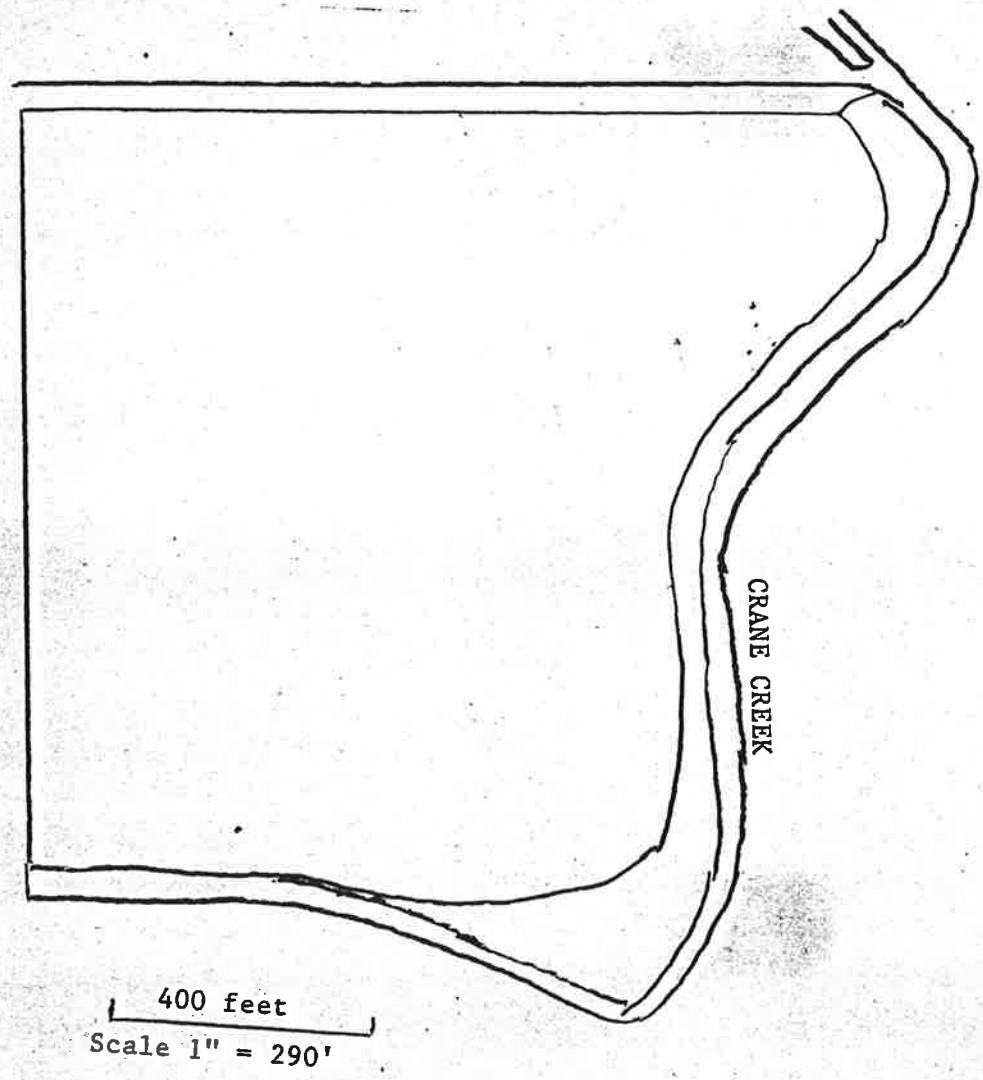
Appendix F. Cropland Unit Maps


Field A - 18 Acres
1994 - Clover 2
1995 - Corn
Field D - 7 Acres
1994 - Corn
1995 - Clover 1
Field D1 - 7 Ac
1994 Clover 2
1995 - Corn
1993 - Clover 2
Field E - 20 acres
1994 - Corn
1995 - Beans
Corn
Soybeans
Clover
Grasslands
Unit 2

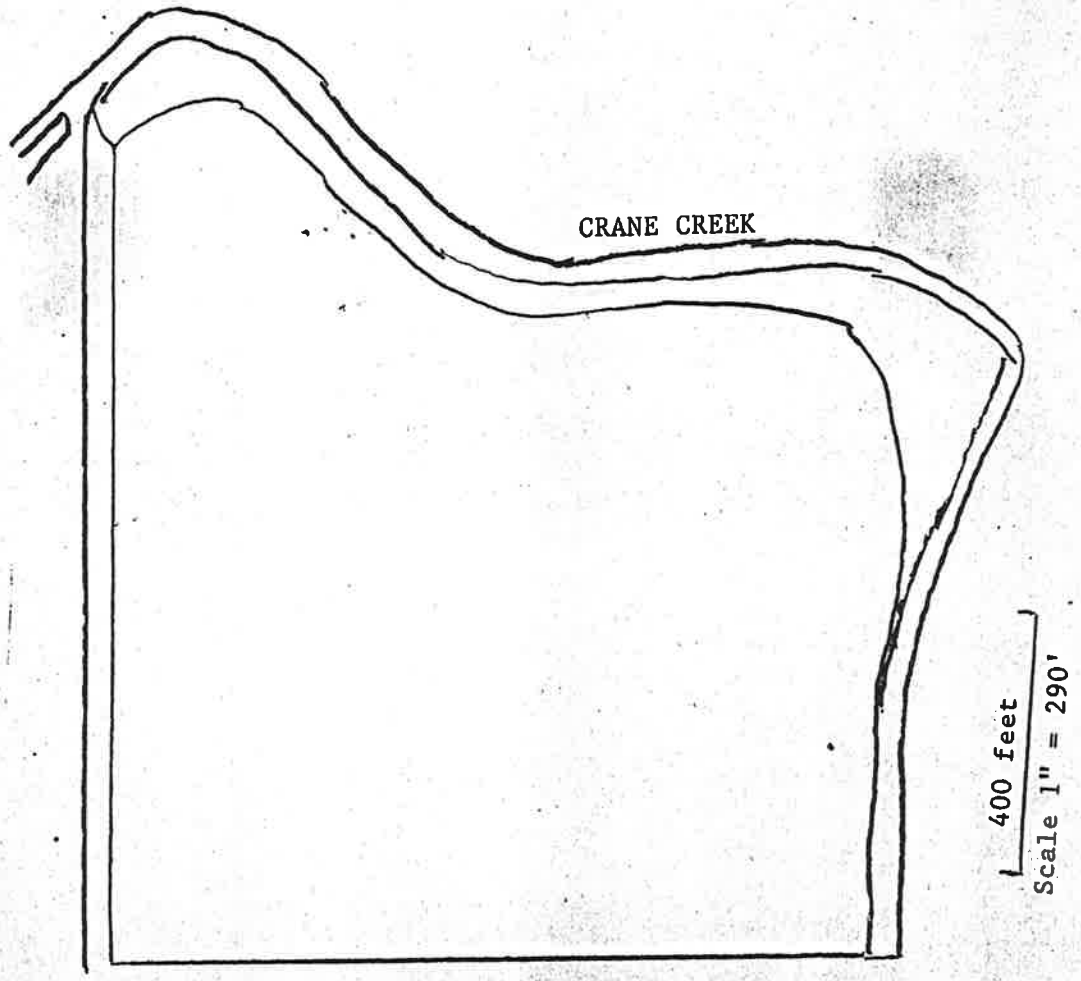

Field A - 14 Acres
1994 - Beans
1995 - Beans
Field B - 11 Acres
1994 - Beans
1995 - Corn
Field C - 7 Acres
1994 - Corn
1995 - Clover 1
Field D - 7 Acres
1994 - Corn
1995 - Clover 1
Unit 6


Unit 9
Field A - 7 acres
1994 - Beans
1995 - Clover 1
Field B - 6 Ac. Grass Bromes Strip
Field C - 12.8 Acres
1994 - Clover 1
1995 - Corn
Field D - 14.5 Acres
1994 -Corn
1995 - Beans
Field A - 10 Acres
1994 - Corn
1995 - Beans
Unit 10
Field E - 10.9 Ac.
1994 - Clover 1
1995 - Clover 2
Field F - 11.4 Ac.
1994 - Beans
1995 - Clover 1
Field G - 7.5 Ac.
1994 - Corn
1995 - Beans
Field B - 8.5 Acres
1994 - Clover 2
1995 - Corn
Field E - 6.5 Ac.
1994 - Clover 1
1995 - Corn

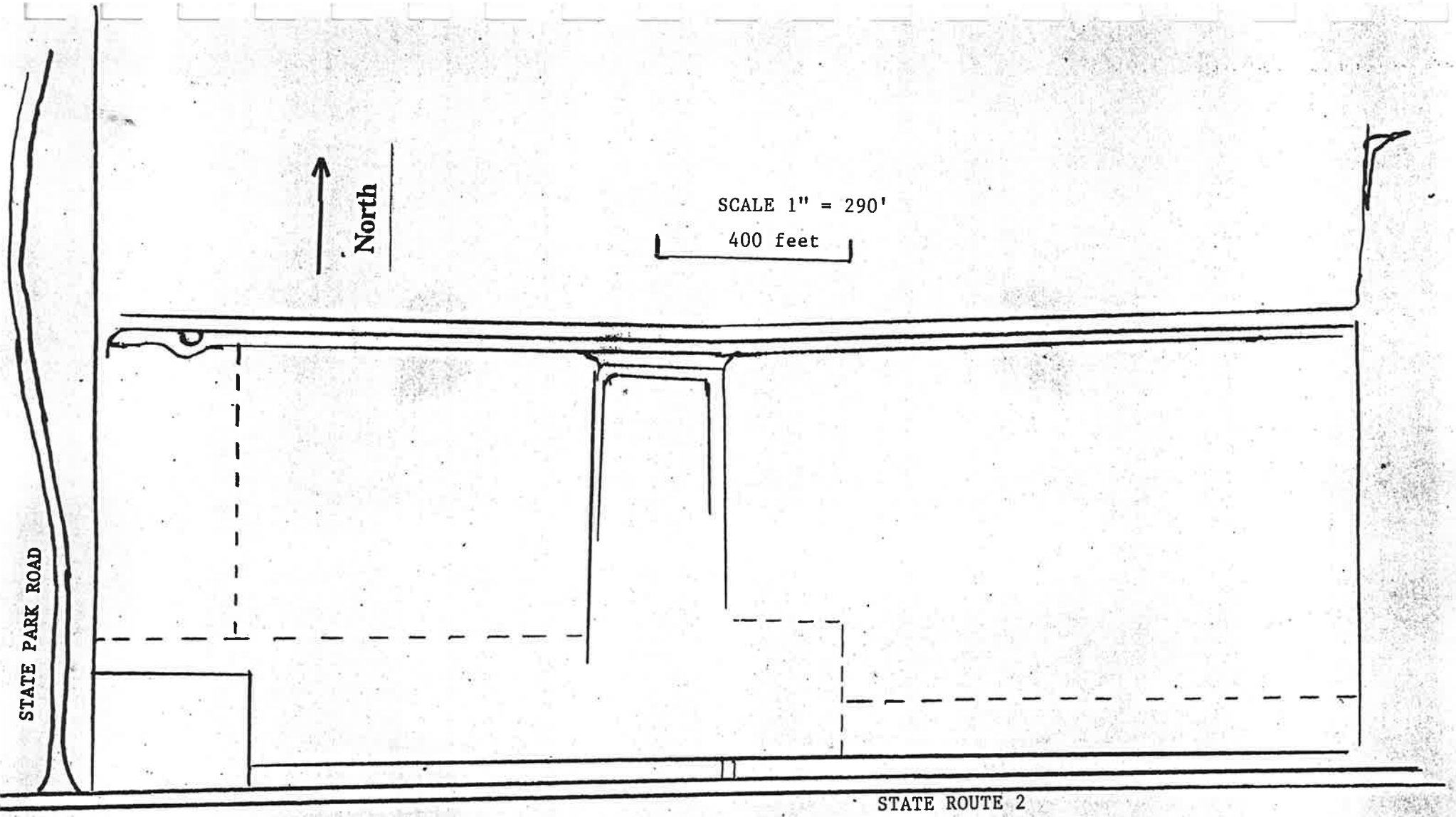

Field A - 14.3 Acres
1994 - Clover 2
1995 - Corn
Field B - 16 Ac
1994 - Corn
1995 - Beans
Field C - 15 Ac
1994 - Beans
1995 - Clover 1
Field D - 22 Ac
1994 - Corn
1995 - Beans
Unit 11
Unit 12



Farm Unit 6A

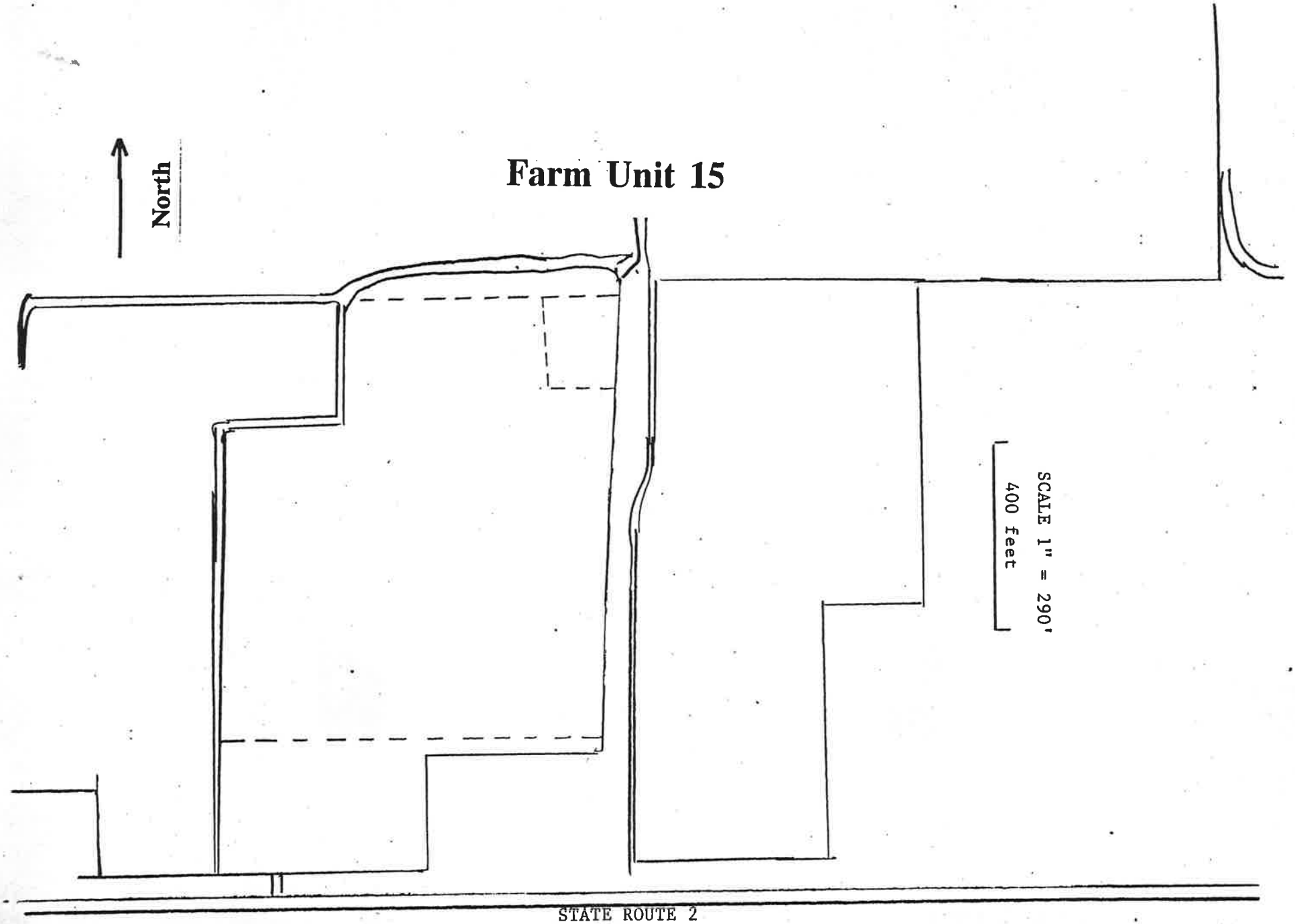


Farm Unit 6A



Farm Unit 14

Farm Unit 15



Farm Unit 16